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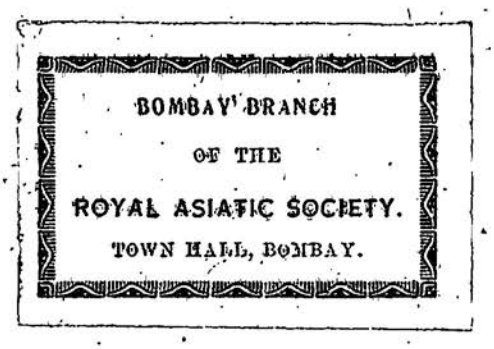

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Reports in this Volume

1 Report of the Panel on "Coir, Rope, Cordage, & other fibre Industries".

2 " " Paper, Pulp, Board, and Chemical Cotton Industries.

3 " " Electrical machinery and equipment Panel on the development of Electrical Industries

4 " " Report of Heavy Chemicals & Electro Chemical Industries Panel

5 " " Leather & Leather Goods.

6 " " Plastics & Celluloid Industries

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REPORT

OF THE

PANEL ON "COIR, ROPE, CORDAGE AND OTHER FIBRE INDUSTRIES".

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Report of the

Panel on "Coir, Rope, Cordage and other Fibre Industries.

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GOVERNMENT OF INDIA

DEPARTMENT OF INDUSTRIES AND SUPPLIES

PANEL ON "COIR, ROPE, CORDAGE AND OTHER FIBRE INDUSTRIES."

——:o:——

REPORT

Introductory

In pursuance of the express policy to promote the rapid industrialisation of the country, the Government of India constituted a number of industrial panels, whose functions were detailed in a "General Directive to Industrial Panels"—reproduced *in extenso* below—issued on the 29th January 1945 and revised on the 15th August 1945:—

It is the function of panels to make recommendations to Government regarding the development of industries, both existing and new. The recommendations should be so framed as to enable Government to prepare a detailed-phased plan for the five years following the cessation of hostilities, as the first stage of a 15-year plan of industrial development for the whole country.

2. In order to assist them to formulate recommendations, panels will be supplied, as far as possible, with factual information prepared by the panel secretaries. In the case of new industries, the information will consist of a general survey of the industry and the importance of starting it in India, the availability of raw material, the power requirements, the demands of the Indian markets and the probabilities of exports. In the case of existing industries, the information will naturally be more comprehensive; it will indicate, in addition, the location of existing units, the types of goods produced, the total production under each category and the assistance, if any, given by Government. These items are to be regarded as illustrative and not exhaustive.

Government will give each panel, as a basis, for discussion, the provisional target to be aimed at in the first five-year period and, wherever possible, of the target to be reached in 15 years.

3. The recommendations of the panels should cover the following points:—

(1) The scope and extent of development, including the type of products recommended.

(1-A) The estimated requirements of capital goods together with such details of those requirements as may be avilable in India and how much should be imported from abroad.

(2) Whether the industry should be under Government ownership either on grounds of national interest or because private capital is unlikely to take it up, and if so, whether it should be wholly or partly managed by Government.

(3) In the case of industries to be developed other than under State ownership, the capital required for such development, whether the whole of it is likely to be available by public investment and, if not, the extent to which Government assistance may be required.

(4) The extent to which technical advice from abroad may be necessary.

(4-A) The availability and the future requirements of technical personnel so as to obtain a clearer indication of the present shortcomings and future needs.

(5) The manner and the degree of co-operation with foreign firms considered necessary and desirable, both as regards capital and management.

(6) The location of the industry.

(7) The nature of the assistance required from Government in the form of protective duties, bounties, research grant, expert advice, etc.,

(7-A) The relative incidence of the import duty on the finished goods in comparison with the duty on the raw materials from which they can be manufactured.

(8) If the industry is to be under private ownership and management what controls, if any, should be exercised by Government.

(9) What should be the organisation of the different units of the industry, e. g., should there be an industrial association? Would a cartel be desirable?

(10) The stages by which the industry should be developed.

(11) Should the industry cater for the export market?

(12) Should the industry be developed, as in Japan, on the cottage industry basis and, if so, to what extent?

4. Although, as stated above, the panels may recommend the grant of protection, it will not be their function to consider broad questions of international trade and commercial policy.

5. Joint meetings of the panels should be held, wherever necessary, to secure co-ordination, particularly where the process and the products, of one industry are connected with those of another.

6. Some of the panels have been drawn broadly and it may be necessary to co-opt members for dealing with specific branches of the industry. Members may be co-opted by the Chairman in consultation with the Industrial Adviser.

7. Before submitting recommendations, panels should consult Provincial Industrial Committees, particularly in the matter of location of industry. They should also, where the circumstances of the case reqiure it, consult Industrial Committees in States or State Governments/Durbars. The recommendations should be submitted to Government through the Industrial Adviser.

2. In his circular letter No. F. 35(1)/45-1. A. dated the 12th November 1945, to all members of Industrial Panels, the Industrial Adviser issued the following explanatory instructions with special reference to items (7) and (7-A) of para 3 of the above General Directive:—

One of the points on which panels are expected to make recommendations is the nature of the assistance required from Government in the form of protective duties, bounties, research grants etc. The question has been raised whether this item calls for a detailed investigation by panels on the degree of protection required and recommendations thereon. What is required from the panel is only a broad indication that protection would or would not be required by an industry and not detailed recommendations which should be left to the Tariff Board to determine. It would not, therefore, be necessary for panels to investigate the costing of individual firms or to make any other elaborate investigation of the conditions of particular firms for the purpose but to base their recommendations on the broad facts of the industries with which they are concerned.

2. The relative incidence of import duty on finished goods in comparison with the duty on the raw materials from which they can be manufactured is another point on which panels have to make recommendations. So far as this point is concerned, Government merely expects that where the panels consider that the relative incidence of import duty on finished goods and their raw material is hampering or likely to hamper Indian industry, they will recommend that the matter be examined by Government. The panels need not themselves examine and make precise recommendations on what rates of import duties might be levied.

3. The "Coir, Rope, Cordage and other Fibre Industries" Panel. consisted of:-

Mr. K. C. Karuna Karan (Chairman), Managing Director, The Alleppey Company Limited, Alleppey, (Travancore State)

Mr. W. Grant, Messers. Aspinwall & Co. Ltd., Cochin.

Mr. S. Ratnam, Deputy Secretary, Finance, Department Government of India, New Delhi.

Mr. Mahmood was first appointed as the Secretary of the panel. In May 1945, Mr. Humayun Mirza, Assistant Industrial Adviser, Department of Planning & Development, Government of India, was appointed as the Secretary in the place of Mr. Mahmood.

4. The factual note prepared by the Secretary was ready on the 24th August 1945 and after its perusal by the Department of Planning and Development, a questionnaire was issued to the Directors of Industries & Commerce in Madras, Bengal, Bombay, Travancore, Cochin, Orissa, Mysore and Bihar with the request to furnish their answers and statistical data in forms prescribed which consisted of six detailed statements. Not all, however, were able to adhere to the prescribed form. In addition the Directors were requested to provide information on, and their reaction to, the following points:-

(*a*) Short description of existing organisation, both factory and cottage.

(*b*) Assessment of present growing demand and uses—diversion in the export destinations compared with pre-war destinations.

(*c*) Methods to be explored for retaining the American and Canadian war-time markets for cheap coir floor-coverings which took the place of the pre-war imports of Japanese, Chinese and Javanese weed and grass mats.

(*d*) Exploration of possibilities of exporting only finished goods—Empire countries should not encourage importation from Belgium and Holland (Mc-Kenna duties)—shipping freight advantage as between baled coir yarn and finished matting should be levelled out in favour of the Indian industry.

(*e*) Assessment of the possibilities of competition from Ceylon, West Indies, Malaya, Dutch Indies and the Philippines.

(*f*) Domestic market not fully exploited—production for local consumption should be increasingly attempted e. g. Bengal can perhaps produce all yarn which it now imports from Travancore, thus leaving Travancore free for catering to the export market. Existing position and developmental possibilities.

(*g*) Proposed targets for production.

(*h*) Certain aspects of production should continue on a cottage basis and mechanical production is possible only in better grades of matting.

(*i*) Investigation of possibilities of mechanical or semi-mechanical spinning on a cottage basis now that hydro-electrical power is widespread.

(*j*) Establishment of roperies.

(*k*) Manufacturers to pool arrangements in regard to the submission of samples for export.

(*l*) Institute for training technicians as also for research.

5. With the material available, the Panel, at its Preliminary Meeting held at New Delhi on 12th March 1946, discussed the various aspects of the problem before them and de cided the lines on which the Report had to be prepared. In this Meeting, the Panel had come to certain definite conclusions and the present Report is based on them.

6. In accordance with the Panel's desire, the Secretary, in the course of his visit to South India, halted for four days in Alleppey, from the 12th to the 15th May, for drawing up the final report. Throughout the report, attention is directed to the present position ; and trends of development are illustrated by comparison with pre-war data. These form the basis of the Panel's recommendations for the future development of the coir industry in a systematic and organised manner.

7. The information contained in the Report about the various coir-producing Provinces and States is drawn from the data furnished by the concerned Directors of Industries & Commerce, to whom the Panel is indebted.

8. It is necessary to mention here that the Panel was originally constituted for " Coir, Rope and Cordage ", but by letter No. F. 11 (1)-I. A./45 of the 17th April 1945 from the Industrial Adviser, the scope of the Panel was enlarged to cover "Coir, Rope, Cordage and other Fibre Industries " and the title of the Panel was altered to " Panel on Coir, Rope, Cordage and other Fibre Industries ".

9. The collection and compilation of factual information and statistical data relating to a scattered and widespread industry like coir demand not only intelligence but also patience and diligence. Mr. Humayun Mirza, the Secretary of the Panel, has tackled this part of the problem with thoroughness and success which was of considerable help to the Panel ; also, in the preparation of the Report, the assistance of Mr. Mirza is much appreciated.

I. Coir Industry

Short Description

10. The coir is the fibre extracted from the husk of the coconut which is grown roughly within the tropical zone. That coconut palm flourishes on sandy soils along the sea coast which is its natural habitat, but it thrives also on other soils in the hinterland. For proper cultivation well-distributed rainfall is essential. Generally speaking, the coconut grows in areas up to an elevation of 2,000 feet above the sea level. The palm begins to flower under suitable conditions in the fifth year and attains full bearing from seven to twelve years of planting. In the main coconut areas, the economic life of the population is almost entirely dependent on the coconut palm.

Area and Production.

11. The following statement shows the distribution of the area under cultivation and production of coconuts:—

(a)

	Acres (in millions)	No. of coconuts (in millions)
Philippines (1936-37)	1·57	3,500
Netherlands East Indies (1937)	1·50	3,200
India (1938-39)	1.50	3,000
Ceylon (1929)	1·10	1,800
British Malaya (1940) ...	0·64	850
British South Sea Islands (1929-30)	0·57	750
Others		900
		14,000

(b) Distribution of the area under cultivation and production of coconuts in respect of India.

	Area in acres	Total in acres	production percentage	Total percentages
BRITISH INDIA				
Madras (1943-44)	605,765	696,193	41.3	46.3
Bengal (1938-39)	31,300		1.4	
Orissa (1938-39)	30,021		1.8	
Bombay (1942-43)	29,197		1·8	
STATES				
Travancore (1938-39)	584,736	821,974	37.8	53.4
Mysore (1944-45)	170,180		11.3	
Cochin (1938-39)	67,058		4.3	
OTHERS				
(British India & States)		7,592	...	0.3
		1,525,759		100.0

12. It will be noted from the statement that Madras, Travancore, Cochin and Mysore account for the bulk of coconut areas in India. So far as the Madras Presidency is concerned, the main coconut area is in Malabar. Travancore and Cochin States and the Malabar District of Madras, which constitute the tract usually described as Keralam, account for over one million acres. This acres lies along a narrow strip of territory between the Western Ghats and the Arabian sea. One of the special feature of this area is that there are vast stretches of backwater fed by river and connected with the sea at points.

Husk—Retting

13. For the extraction of coir fibre from the husk, fresh husk is to be retted. Retting facilities and nearness to backwater, therefore, play a very important part in the production of coir fibre. This accounts for the development of the coir industry in the Travancore and Cochin States and Malabar where retting facilities are available. The husks have to be kept under water for a period of six to ten months before they can be soft enough for the extraction of fibre. Brackish water with scour offers the most advantageous place for retting of husks. This accounts for the fact that the best varieties of coir yarn are produced in Travancore, where natural facilities are so plentiful. As stated before, there is a vast stretch of backwater along the coast belt of Malabar which is connected with the sea at certain points and it is along this belt that coir yarn production is almost entirely carried on. Coir fibre can also be extracted – and this method is adopted where there are no backwater areas suitable for retting – by either burying the husks in sandy soils or keeping them in small pools of water. The husks so treated for a short period only yield a type of coarse fibre with large admixture of pith and it is also of brown colour. This is a low grade fibre.

Coir Fibre

14. Fibre extracted from properly retted husks is of a light golden colour, clean and free from pith and other impurities. The better quality of fibre is used for various purposes It is spun by means of wheels or by hand into coir yarn which is extensively used for mattings, rugs, carpets and other floor-coverings. From the high grade fibre, fibre mats of value are also manufactured. From the coarser varieties of coir fibre, coir mats of cheaper quality are manufactured. The coir yarn is also used in the manufacture of rope and cordage.

15. There has been practically no research on the methods of retting and the extraction of fibre although various experiments have been made for scientifically treating the husks with a view to avoiding the long period required for retting. Some of these experiments have been successful, but whether these scientific methods could be adapted on a commercial scale cheap enough to produce coir yarn at economic levels has to be tried. The Research Laboratory of the Travancore University has been experimenting on the production of coir fibre and it has been able to evolve certain methods of production. They have, however, not been put to commercial use.

16. On account of resistence to rot and also to white ants to a large extent, coir fibre has immense prospects amongst the various fibres of the world, apart from its use in the manufacture of floor coverings and rope. The present War has shown that coir can be utilised

for various purposes one of which is in the making of roads or producing a good wearing surface. The use of coir in the preparation of protective lagging materials for underground pipes, such as gas, oil or water pipes and cables, subjected ordinarily to the corroding influences of bacteria, electrolytic action for tramways, etc., and chemical corrosion from the clay and soil itself in which it is buried, has successfully passed the exeprimental stage.

Organisation

17. The retted husks, after washing for the removal of mud and other impurities, are beaten with wooden mallets. This is mostly done by women in and around their homes. The fibre so extracted is cleaned and dried in the shade and willowed and is then ready for spinning into coir yarn or for the manufacture of superoir mats. On any average, husks of 3,500 to 4,000 nuts yield a candy of coir yarn in Travancore (Candy =672 lbs.)

Coir Yarn

18. The production of coir yarn in Travancore, Cochin and Malabar is also on a cottage basis. The yarn is spun either by hand or by means of two wheels, but the latter is the more prevalent method. The yarn spun by hand is of soft and even twist, while that spun on wheels is hard twist and not so even as hand spun. This difference in method of production gives the basis for classifying coir yarn as " hard twist " and "soft twist ". In the spinning of coir yarn as in the extraction of fibre, women and boys and girls find employment. The well-known varieties of coir yarn produced in Travancore, Cochin and Malabar and known to the trade are :—

Travancore	1.	Anjengo Superior (Hard twist)
	2.	Anjengo ordinary or Mangadan (Hard twist).
	3.	Ashtamudi (Hard twist).
	4.	Alapat (Soft twist).
	5.	Aratory (Hard twist)
	6.	Vycome (Hard and Soft twist).
	7.	Beach (Soft twist)
Cochin	8.	Fine Weaving Yarn (Soft twist).
	9.	Rope Yarn (Soft twist).
Malabar	10.	Beypore yarn.
	11.	Quilandy yarn.
	12.	Calicut (Fine Unsoaked).
	13	Div yarn (from Laccadives and Maldives).

The Beach yarn is a low grade product as the husk from which it is produced is not properly retted and sometimes not retted at all. It contains a large quantity of pith and is of a reddish brown colour. The tensile strength is also low.

Marketing

19. The yarn produced in the spinning districts is marketed–there are a number of middlemen in this field – chiefly in Alleppey where there are a large number of factories for the manufacture of mats, mattings, rugs and carpets and also exporters of yarn to the Indian and overseas markets. Export of yarn to overseas market is invarialy in hydraulically pressed bales of 3 cwt. each. Exports to Indian markets is in hand-made bundles.

Coir Mats and Mattings Manufacture.

20. Mats and mattings are manufactured on wooden looms which are similar to those used for other textiles and are operated by manual labour. Mats, mattings, rugs and carpets are made in a large variety of exquisite designs and patterns and offer a useful, damp-proof and pleasing floorcovering. Although there are several large-scale factories for the manufacture of mats and mattings, there are a very large number of small industrial establishments which are on a cottage basis as in cotton weaving. Altogether there are about 361 establishments in Travancore, large and small, employing approximately 30,000 workers. Although Travancore is the chief manufacturing centre, there are a few factories in Cochin and Malabar. As in the production of coir yarn, the cottage aspect of the industry is an important factor in the economics of this industry which should not be lost sight of.

Estimates of Production of Coir—Manufactured and Unmanufactured.

21. Following are the estimates of production of Coir—Manufactured and unmanufactured :—

Madras	...	...	25,038 tons
Travancore	...	...	80,000 „
Cochin	...	...	17,000 „
Mysore	...	...	not available
Bombay	...	...	63 tons
Bengal	...	...	225 „

22. Being a cottage industry spread along the whole sea coast, production figures are difficult to obtain and no attempt has been made so far to make a census of production. Production figures are therefore only in the nature of estimates based on exports. So far as Travancore is concerned, the average production of coir during the pre-war period is estimated at 80,000 tons a year. Production during the War period has considerably dwindled mainly owing to the shrinkage of the usual markets, shortage of labour due to recruitment for military purposes and inadequate return for labour.

23. Coir yarn, mats, mattings and rugs produced in Travancore are exported through Alleppey, the main port of shipment in Travancore, and also through the port of Cochin, so much so that if exports from Travancore through Alleppey and overland routes are taken along with the exports through Cochin, there would be some duplication. The best method of ascertaining more accurately the volume of export from Travancore and Cochin would be to take the combined figures of exports from Alleppey and Cochin. Separate figures to show Cochin production are not available but it is estimated at 5 per cent of the total for Travancore and Cochin. Figures for railborne trade are also not available. These factors have to be borne in mind in making estimates of production. Statement I gives the shipments of coir fibre, coir yarn, coir rope and mats and mattings from the ports of Alleppey, Cochin, Calicut and other Malabar Coast Ports, which are the principal centres of the export trade.

Coir for War Purposes

24. The following tabular statement gives the extent of the War orders :—

	1942	1943	1944	1945 (estimated)
Rope :				
Length (in ft.)	42,54,000	1,24,50,000	54,00,000	24,00,000
Value Rs.	29,000	1,35,000	2,36,000	1,50,000
Fibre and Yarn.				
Weight (in tons) (1 ton=2240 lbs)	Nil	1,900	1,200	5,000
Value Rs.	Nil	3,61,000	3,10,000	14,00,000
Mats and Matting.				
Area (in sq. yds.)	Nil	29,15,000	18,50,000	13,00,000
Value Rs.	Nil	28,12,000	15,90,000	20,00,000
Tentage components (Salitahs Large, Bags of various types for packing tent poles etc.,)				
Numbers.	2,32,000	4,00,000	18,00,000	10,00,000
Value Rs.	11,80,000	5,37,000	44,90,000	23,00,000

25. The above War orders represent direct Government of India purchases; 25,000 tons (which include His Majesty's Government's purchases) were exported to foreign countries and 33,000 tons (inclusive of indirect purchases for war purposes) were used for internal civilian consumption. Direct Government of India purchases in 1945 were 12,000 tons.

Loss of Export markets

26. From the aspect of being their chief industry, Travancore Cochin and Malabar had in the early stages of the war suffered very badly owing to loss of their export markets. This position had to a very great extent righted itself, and prices of coir ropes and other articles now are very high. There is no reason to think that coir would not be in a position to recapture all its markets after the War. The rope manufacturers are interested in their export trade, which had been principally in the East, to the ports of Akyab, Penang, Rangoon, Saigon, Bangkok, Shanghai, etc. The aspect would have to be borne in mind in any scheme of reconstruction in the immediate future.

Markets for Coir and Coir Products

27. Prior to the War, the principal markets for coir mats and mattings were, in the order of their importance, the United Kingdom, Australia and New Zealand, the United States of America, Africa, Holland, followed by almost all countries in Europe except U.S.S.R., Italy, Greece and a few others. The Middle East countries and India also absorbed a considerable quantity of these manufactured articles. As regards, coir yarn, practically all countries in Europe, the Middle East, United States of America, Africa, Australia and New Zealand were importing substantial quantities. The accompanying statement II gives the proportion of off-take by various countries of manufactured coir goods and coir yarn during 1937-38. It will be seen from the statements that the United Kingdom was our principal market. Some of the countries which were importing large quantities of coir yarn have their own manufacturing industry, chief among them

being Holland and Belgium. The United Kingdom also has a few factories for the manufacture of coir matting. The comparative unevenness of the coir yarn and the difficulties and cost of adapting it to mechanical means of manufacturing Ropes and Cordages have to a certain extent checked the growth of the manufacturing industry in other countries.

28. During the War, the United Kindgdom reduced her off-take very considerably whilst almost all the European markets were lost to us. Restrictions on the import of mats and mattings were imposed by all our importing countries on financial grounds. The United States of America with her high tariff wall, which was not a favourable market prior to the war, has now emerged as one of our important buyers. Other cheap floorcoverings, such as China grass mats, are not available and the present demand from America, and Canada is perhaps only a temporary phenomenon. But it would be essential to consolidate our position in this market making the best use of the opportunity now offered. Establishing ourselves in this and other new markets is dependent largely on quality to which the trade and all interested have to devote their earnest attention. There is also every prospect of the European countries, during the period of rebuilding, importing large quantities of coir mats and mattings, in addition to establishing factories for which purpose also they would be importing consideralbe quantities of coir yarn. It is doubtful whether in their present disrupted state of economy the European countries could devote their man-power for other than agricultural operations, building and other essential industries In any event it is very important that the position in these and other markets should be studied closely with a view to expanding our markets for the manufactured goods.

Post-war target

29. The panel agrees to adopt the potential production figures relating to fibre and yarn as would be given by the various Provinces/States, regarding these as the target figures. The panel's recommendation for the post-war target is as under:—

	Existing coconut acreage.	Coir—Manufactured and Unmanufactured. (tons)
Madras	6,05,765	1,00,000
Bombay	29,197	7,500 *
Bengal	31,300	225 *
Travancore	5,84,736	1,00,000
Cochin	67,058	19,000
Mysore	1,70,180	2,400

*These figures have been worked out on the basis of the reports furnished by the concerned Directors of Industries and Commerce.

30. Bombay and Bengal should aim at catering for local consumption leaving Travancore, Cochin and Malabar for manufacturing and exporting coir yarn and manufactures there of; and Bombay and Bengal should attain self-sufficiency.

31. Lack of reliable data as to the present production of coir yarn precludes the possibility of making any forecast for the future. It is estimated that, with the return to normal avocations of those in the services and a general readjustment of the present War-time econo-

my to normalcy, the production of coir yarn in Travancore can be stepped up to 1,00,000 tons. The development of coir yarn in other coconut areas would depend on the introduction of improved methods of retting. During the normal times only about 60 per cent of the total quantity of husk available was utilized in the production of fibre in Travancore and Cochin ; in other centres, it is much lower. Even under the existing methods of production, it would be possible to increase this quantity by means of improvement of roads, canals and rivers so as to enable the husks available in the hinterland to reach the retting areas quickly and cheaply.

Chemical and Mechanical meth.ds— possibilities.

32. This leads to a consideration of the practicability and desirability of introducing mechanical means of production of fibre and yarn and the use of chemical methods for retting.

Reference :—

(i) The Nanji Process,
(ii) Elod and Thomas Process.
(iii) Rowell Process,
(iv) The Van der Jagt Process, and
(v) The "H. G." Process, with ionised oil

The Director of Research, Travancore University, has evolved certain methods of scientifically retting the husk and extracting fibre from such husk. Assuming that this may become a commercially workable proposition, it has the decided advantages of saving time More-important is the possibility of utilizing all the available. husk in the country for the extraction of fibre. There are also other processes, some of which have been patented, for the softening of the husk by the use of chemicals. The commercial possibilities remain to be tested in relation to the cost and availability of the chemicals required. Recently, the Director of Research of the Travancore University obtained certain information regarding the equipment of machinery for breaking up the husks by mechanical means and extraction of fibre and also spinninng of coir yarn.

33 In adapting mechanical or chemical means of producing fibre, the following points, among others, deserve serious consideration :—

(a) The industry is now spread along the Malabar Coast and is, entirely a cottage industry. Introduction of machinery or chemical means would disrupt the existing village economy. When industrially we are not advanced enough to absorb the unemployed population, it is not good, in the opinion of the Panel, to introduce either machinery or chemical means that would deviate from the cottage character or characteristics, as it were, of the coir industry. There are about 100,000 families in Travancore dependent on this industry for their living.

(b) Supposing a factory is established in some central place, is it a practical and economic proposition to transport all the husks to the factory to be converted into coir yarn? The Panel is of opinion that it is not so in the present circumstances.

34. Without disrupting village economy, if it is possible to introduce some cheap and easy machinery worked by manual labour, such as ginning in cotton, it would considerably remove the tedium of this process and help lighten the burden of workers in this very laborious process. Immediate research should be directed to this end

35. On the marketing side, reports reveal the existence of a multiplicity of middlemen. If an industry in which the unit of production is so small, the presence of middlemen is an inevitable phenomenon. This can be modified only by the organization of co-operative societies to which it is understood the Registrar of Co-operative Societies in Travancore is already devoting his attention. It may be a slow process, but has to be quickened.

Improvement in marketing

36. On the point of the improvement of coir yarn, the Panel is of opinion that for the time being, generally grading should be confined to describing well defined qualities and to estimating the moisture content and the foreign matter content. Towards such improvement and with a view to affording finance facilities for the producer, the Travancore Government have sponsored a Licensed Warehouse Bill. It is hoped hat tthe Government will immediately follow this by a Grading Act.

Quality and Grading

37. Statement I showing the shipments of coir yarn and manufactured coir goods will reveal the proportion of shipments of raw materials in relation to shipments of manufactured products. Whilst the raw product may be used in the importing countries for other uses than in the manufacture of mats and mattings, it is necessary to ascertain the position accurately and take such steps as are necessary and possible to develop the manufacturing industry in the country of production of the raw material. At any rate, this should be kept as an objective in the post-war policy for the coir industry. This is not altogether wrong on economic grounds as it is one of the orthodox economic canons that the fostering of an industry should be based on the availability of raw materials at hand.

Fuller use of raw material

38. Consideration has also to be given to, and a study made of, the possible sources of competition to the coir industry --

Competition and the future position of the industry

(a) Already Ceylon is producing coir fibre, her annual output being approximately 12,000 tons. This fibre is mostly used as bristle fibre, not being soft enough to be spun into coir yarn. But a certain quantity of coir yarn is also being produced in the island amounting to 5.000 tons approximately. With the retting facilities now available in Ceylon and improvement in the method of harvesting nuts, there is every possiblity of Ceylon being able to increase her production of fibre and yarn. Ceylon has also started manufacture of coir mats and mattings, though on a small scale Under the existing methods of production adopted in Ceylon and considering the demand and future possibilities of expansion of the markets and of the uses the coir may be put to, Ceylon does not offer any serious threat to India for the time being.

(b) Jute floorcoverings are now in demand. but how far it can compete with coir is a matter which requires close study. Calcutta factories are manufacturing jute mattings on power driven looms and can increase their output rapidly and sell cheaply The wearing and damp-proof qualities of coir mattings are considered superior.

(c) Production on a large scale of various kinds of floorcoverings out of sea weeds and grass from China and Japan was, in the prewar days, a factor to be reckoned with as a growing competition against the coir floorcoverings. Grass was *cultivated* on a large scale and under up-to-date methods in China and the production of various floorcoverings and also furniture like collapsible chairs etc. was an important cottage

industry ; in Japan not only was this carried on on a large cottage basis but the Government interference in regard to inspection of qualities has pushed these floorcoverings, to a large extent, in the markets of the United States of America and United Kingdom. Apart from the nature of this scientific cultivation and the Government control given to the production of these floorcoverings, the freight facilities from China and Japan to the consuming countries played a considerable part in enabling these floorcoverings from China and Japan to enter into active competition with the coir floorcoverings imported from India into these countries. No doubt, in the prewar days the United States of America was not an important market for coir floorcoverings owing to the climatic conditions of the country, the method of use and the availability of cheap floorcoverings from other sources. In the United Kingdom grass floorcoverings were largely used not because of their superiority over coir as cheap, durable and damp-resisting floorcoverings but because of the comparative cheapness of the commodity particularly facilitated by cheaper freight On coir floorcoverings, the freight from Malabar Coast to United Kingdom is controlled by the Conference Lines, with the result that the freight rates are much dearer than those on grass floorcoverings. The situation has become changed during the War and this change will very probably continue for four to five years. It is reported that the vast areas under grass cultivation in China are being now put under food crops. This is based on the assumption that the food situation of the World was not likely to improve within that period and there will not be available lands as in the prewar period for the cultivation of grass Therefore in so far as competition from grass floorcoverings from China and Japan is concerned, the probability is distant.

39. We may now consider the question of competition from other hard fibres such as Manila hemp, Javan Sisal and East African Sisal etc.

Prior to the War, coir was not taken into any serious consideration as a fibre suitable for cordage purposes in comparison with Manila hemp, Dutch East Indies hemp etc. and in fact, coir was taken as one of the most lowly of the industrial fibres. It was during the War when, due to Japanese occupation of the Philippine Islands and the Dutch East Indies, Manila hemp and Javan Sisal ceased to be available, that coir began to be used for cordage purposes. It was found to be a suitable substitute and the demand for War purposes continued. It may naturally be expected that now that hostilities have ceased, the Philippines and Dutch East Indies as sources of supply will again come into existence. But the following facts have to be borne in mind in estimating the probable competition from these and other sources :—

(a) Before the War the Philippine exports of Hard hemp chiefly Manila hemp were between 150,000 and 200,000 tons, but it is unlikely that more than a *fraction* of this quantity can be exported for some time. Under Japanese occupation, some plantations have been used for other agricultural purposes, others neglected and all of them were short of equipment—a particularly serious matter ; hard hemp plantations require more equipment in the way of field railways and leaf crushing and fibre extracting plants than any other plantation industry. For reconstruction and rehabilitation of the industry in the Philippines and in the Dutch East Indies, we can safely estimate that it will take some five years.

(b) The East African production of Sisal now exceeds the prewar peak of 1[illegible]0,000 tons per annum and in Mexico, Henequen hemp production has been encouraging. Experiments in some African areas and

Central America have occasionally been successful, but their contribution to supplies is so far small. Unfortunately, American plans for hard hemp production have proved over-ambitious, and the 1943 acreage fell short by 24,300 acres of the programme to plant 300,000 acres for fibre and 50,000 for seeds. In 1944, it was reduced to 72,000 acres and the scheme has now been virtually discontinued.

(c) Portuguese East Africa has a considerable acreage under cotton where Sisal growing is also carried on extensively and considerable quantities exported. Portuguese East Africa and Angola on the West African Coast possess a number of indigenous fibre producing plants The natural history and pathology of those in the latter Colony have been very thoroughly studied by and under the Direction of Senor Lara, head of the Companhia do Acucar de Angola.

(d) A scheme for the commercial exploitation of many fibre plants is in progress in Columbia under sponsorship of the National Institute of Development. Trial plantings of fibre plants have been made by the Columbian Bank of Industrial Development and it is thought that domestic cultivation should be able to cover some of Columbia's textile requirements and provide an export surplus.

(e) The short supply of hard fibres is seen by the wider use of Abaca fibre , grown in British North Borneo in the manufacture of Rope now permitted in the United States of America. This will replace a like quantity of Sisal. The change has been made following a drop in shipments of Sisal from British East Africa as a result of the discontinuance of the Combined Raw Materials Board The fact that the United States of America has recently allowed Manila Rope to be manufactured in $\frac{1}{4}$" diameter ($3\frac{1}{4}$" in circumference) indicates the short supply of Manila fibre from philippines.

(f) The attempts made in Chile, Palestine, Cyprus and Italy to grow hemp on a large and extensive scale are to be carefully noted. The cultivation of piteira fibre in South America has to be specially noted, as this fibre resembles Sisal in several ways. The fibre is however weaker when compared to Sisal, but it is possible that the relative softness of Piteira fibre might enable it to find uses not generally available to the hard fibres, to which group it belongs.

40. The conclusion that has to be drawn from the above factors is that only East African Sisal will be of any material factor to the world's supply among hard fibres. For constructional and other purposes, when the demand for Cordage is so immense, the East African production is not likely for some years to be a material factor to be reckoned with.

Post- War Development

41. Against the above favourable background for Coir during the four to five years from now. serious consideration should be given in drawing up a 15 year plan of industrial development for the whole of India as far as hard fibres are concerned. The cultivation of industrial fibre plants on a large plantation scale with the aid of up-to-date machinery should engage the serious attention of the various Governments. Large uncultivated areas in India having almost the same climatic conditions as East Africa are suited for large scale Sisal plantations. The damp-resisting quality of this fibre will certainly play an important part not only in the manufacture of Rope and Cordage, but also in that of cheap floorcoverings.

42. The greatly increased use of synthetic fibres is a factor to be carefully watched in future. Such costly synthetic fibres have not yet come into any great prominence in the Rope, Cordage and cheap

floorcovering industries. But it may be possible through intensive research to produce synthetic fibres, which may, with advantage, be used in these industries. Recently American Viscose Corporation obtained a patent in the United States of America for producing Cellulose other than in the form of separable fibres for use in the Cordage industry.

43. In considering competition, cost of production will be a governing factor. Before the war. in China and Japan, labour was paid very low and made to work for long hours, and in some cases, the wage rates are reported to be less than that in the coir industry. Although China and Japan were members of the International Labour Organization, sweated labour prevailed in the grass floorcovering industry. This state of affairs will never recur now under the influence of the United Nations Organization and we can safely expect that such sweated labour will not be permitted in future.

44. Apart from the considerations of Competition, the usefulness of coir has now become well-established and there is no question that its popularity in the buying countries will continue in the future provided sufficient consideration is given to quality. Reports in the British Press show appreciation of the coir floorcoverings as a material possessing a high degree of damp-resisting and hard-wearing qualities.

45 Active steps for stepping up production of coir in India should be taken up immediately. Improvement in transport facilities to enable husks from the hinterland being brought to soaking pits has been suggested already as one of the means to attain this end. Ways and means should also be explored for producing coir locally in the various coconut producing areas in India where natural retting facilities do not exist. It is possible that in irrigated areas, husks can be soaked and coir produced. These are matters. which should engage the attention of the Governments concerned. With the development of production of coir in the coconut producing areas, the local demand for coir as fibre and as yarn could at least partly be met and this will enable Travancore, Cochin and Malabar to explore fresh markets for the manufactured coir goods and expand existing ones. An intensive drive should also be made, in any case, for the improvement and expansion of coconut cultivation.

46. Another point which requires immediate consideration in connection with the improvement of the coir industry relates to marketing In the preliminary stages, it is a fact that there are quite a number of middlemen and the spreading of the Co-operative Movement will be a good corrective. This point has already been dealt with earlier in this report. But in regard to marketing at the consuming centres, coir has not been placed on a proper footing. In fact, it is not quoted in the London commodity market at all It is contended that the qualities are so various that it is not possible and would in fact be misleading to quote prices.

47. The correctness of such a contention has to be examined carefully before it can be accepted. But it has to be conceded that there is no scientific grading of this commodity which is necessary for coir being quoted in the commodity market and marketed under very well-known procedure. Today, the marketing of coir in Great Britain usually takes the form of the buyer visiting merchants office where business becomes a matter of negotiation. This is a procedure not entirely unkown with other commodities. Better prices can be obtained, if proper grading is adopted. If the absence of grading stands in the way,

then it might be taken as further evidence as the desirability of solving the garding problem. Without clearly defining grades, and without public prices the future of the most meritorious commodity must be handicapped.

Roperies

48. The possibilities of establishing roperies in Cochin, Travancore, Malabar and Bombay should also be studied with a view to expanding the manufacturing industry in the country and absorbing more of the raw material. The Panel is of opinion that for an economical ropery not merely coir but also other fibres such as manila, sisal, hemp and Jute should be made readily available.

Improved Machinery in manufacture

49. It may be noted here that coir machinery has not received the amount of attention from textile machinists which has been accorded to certain of the other hard fibres. From time to time substantial developments are promised, as for example the Van der Jagt decorticator and the Hayes—Gratze process which employs ionization for separating and softening the fibre. But the innovations have, to date, failed to secure general acceptance.

50 A certain amount of work has been done at Leeds by Fairbairn Lawson Combe Barbour more especially in connection with spinning, while the Suffolk firm of Messrs E. W Downs & Son is one of the very few concerns which cover coir machinery needs from several angles—decortication, bale opening, cording and cleaning equipment for preparing mattress fibre and machines and implements for the production of coir mats and mattings.

Research

51. Above all, the possibilities of coir are so great and experiments so far made so few that there is an urgent need for the establishment of a Coir Textile Institute for the study of coir in all its aspects From the agricultural point of view the cultivation of the coconut has received a great deal of attention, but when compared to other animal, vegetable and synthetic fibres, the fibrous product of the coconut palm has received very scanty attention at the hands of Research scientists.

52 The scattered nature of the industry and the small units involved are mostly responsible for the lack of research in the various stages of the coir industry. Recent years have proved the various uses to which coir could be put The place of coir in the world fibre economy has come to stay What is needed today is intensive research, particularly in the early stages of the industry. This search must be internal as well as external Internally the aim must be to observe, measure and record everything connected with the problem so that when knowledge is obtained from outside, it could be applied to what is inside Externally the search must be in scientific institutions and among suppliers of materials or machinery.

53 It is advisable for the industry, with the close co-operation of the Government to possess a Co-operative Research Institute. If an item of knowledge is located at such a Co-operative Research Institute, it should be presumably available to all members, large and small.

54. It is felt that the whole Coir Textile Industry would benefit if at least one person properly trained were available in every Mill or Factory. It is suggested that opportunities be given to students who

wish to train for such qualification. A close interest is to be taken by the Institute in the provision of standard text books and works of reference and a more thorough going approach be made for standardization of terms, definitions and methods.

55. The fact that coir, properly treated, resists decay, is not disintegrated by bacteria nor harmed by water, and can be easily impregnated with bituminous and resinous materials provides a unique opportunity for exploiting its uses in directions hitherto untried in commerce or industry; but modren industry must have a scientific foundation and fundamental characteristics of coir must be explored by scientific research, if, as with coconut oil, knowledge is to be yielded for its development in new directions.

56. In the foregoing paragraphs, we have dealt with the several aspects of the coir industry. We propose now to deal with certain other points which arise for consideration underh te terms of reference to this Panel.

Whether the industry should be nationalized.

57. It will be clear from the general discussion and the presen organization of the industry as detailed in previous paragraphs that the coir industry does not hold a key position such as will justify Government taking it over under its ownership either on grounds of national interest or because private capital is not available. Indeed, the coir industry is fundamentally a cottage industry and spread over practically the whole of the coastal region of Travancore, Cochin and Malabar The production of coir yarn does not stand in need of any large capital investment and the improvement which have to be made on its present organization relate to co-operative effort and better marketing methods. In the manufature of coir mats and matting, which is more on a factory basis, the industry has become well-established through several decades and capital has never been found to be shy There are certain weak points, no doubt, in the organization of the industry in respect of the manufacture of coir mats and mattings. The problems facing the industry have been well understood and the larger manufacturers have established an association by the name of The Travancore Coir Mats & Matting Manufacturers' Association which has been recognised by the Travancore Government. It is a body incorporated under the Travancore Companies Act by virtue of a licen e issued by the Travancore Government A similar association exists in Cochin also. Assistance of fhe Government towards a better organization of the industry may be required but it is a matter which should be left to the industrialists themselves to seek. Moreover, in addition to several larger factories, many small industrial establishments working more or less on cottage basis, have come into existence. The problem of the industry is therefore one of organization and definitely not one such as will necessitate Government ownership.

Co-operation with foreign firms

58. In the coir mats and matting manufacturing industry, there already exists a certain amount of co-operation as the Association referred to in the previous paragraph consists of both Indian and European manufacturers. Indian enterprise has never been lacking in this industry which does not therefore stand in need either of foreign capital or of management for its future progress.

Nature of Governmental assistance

59. In the appropriate places, we have recommended the form of Government assistance which may be required by the coir industry and it does not appear to be necessary to repeat them ; but it would not be out of place to recapitulate here our main recommendations in this respect.

(a) Improvement of communications with a view to facilitate the transport of fresh husks from the producing areas to the soaking pits, thereby increasing production of coir yarn

(b) Improvement in marketing methods and legislation for establishment of Licensed Warehouses and grading will result in the improvement of the quality of coir yarn Establishment of Licensed Warehouses will also increase the financial facilities.

(c) The Co-operative Departments of the Governments concerned should take an active part in the promotion of Co-operative Societies in connection with spinning and marketing of coir yarn.

(d) Suitable policy which will ensure the fullest utilization of the raw material in the manufacturing industry to the extent possible should be adopted by Governments concerned.

(e) Endeavour should be made by Governments concerned to secure a reduction in tariffs in countries importing coir mats and mattings. In certain countries (e. g., Australia) the import duty on coir mats and mattings is found to be higher than certain other floorcoverings which is a handicap to the coir industry. Governments concerned should endeavour to remove such handicaps.

(f) In the present stage, no protective duties or bounties are required for the development of the coir industry. The Government of Travancore have for fiscal purposes a duty on the export of coir yarn.

(g) Co-operation and financial assistance of Government for research purposes would be very helpful. We have recommended the establishment of a Co-operative Research Institute in paragraph 53.

Government Controls

60. Of late there have been criticisms regarding the quality of manufactured coir goods exported which seemed to suggest the desirability of some form of Government control regarding quality. There is always serious difficulty accompanying the establishment of Government controls for licensing of quality etc. Ethics in trade should ordinarily be based on some code agreed upon by a voluntary association of manufacturers and exporters. Such being the case, Governmental controls for ensuring proper quality are not desirable unless it is proved that the conditions in an industry are so chaotic that they become a danger to the industry itself. The maximum interference by Government in regard to the coir mats and matting industry is perhaps needed only for the purpose of compelling all manufacturers to form into an association or associations which should be left to prescribe their own codes for the maintenance of proper grades and standards for the products manufactured and exported. Beyond this, the industry does not seem to need any control from Government.

II ROPE

AND

III OTHER FIBRE INDUSTRIES.

61. As regards the consideration of the "Rope Industry" and "Other Fibre Industries", the Panel is of opinion that as at present constituted it could make no important contribution to the development of the Rope' Industry (other than the coir rope industry) and "other fibre industries' Some of these fibres are still in the agricultural or experimental stage of their development and are not as yet cultivated intensively to be "industrially' important.

(S.d.) K C. KARUNA KARAN
(CHAIRMAN)

(Sd.) W. GRANT (Subject to Notes attached)

Sd) HUMAYUN MIRZA
(SECRETARY)

(Sd.) S. RATNAM

Summary of Recommendations.

1. The Panel decided to confine its attention to the Coir Industry merely (and Rope, in so far as it is of coir manufacture) for the reason that the various indigenous fibres were not grown sufficiently extensively to admit of their utilization to any marked degree in any industry of note.

2. The Panel has adopted the following targets -

	Coconut Acreage	*Coir (Mauufactured and Unmanufactured) (tons)*
Madras	6,05,765	1,00,000
Travancore	5,84,736	1 00,000
Mysore	1,70 180	2,400
Cochin	68,895	19,000
Bengal	31.300	225
Bombay	29,197	7,500
	14,90,073	2,29.125

Bombay and Bengal should aim at catering for local consumption leaving Travancore, Cochin and Madras (Malabar) for manufacturing and exporting coir yarn and manufactures thereof. Bombay and Bengal should attain self-sufficiency.

3. *Steps for improving the Coir Industry* :—

(i) Methods for improving production.

(a) As husk is only partially utilised in the production of fibre (60% in Travancore and Cochin and even much less in other centres—0.06% in Bengal, 3/4% in Bombay), it is most important that all the available husks should be utilised ;

(b) Improved communications—roads, canals, rivers—for enabling the husks in the hinterland to reach the retting areas quickly and cheaply ;

(c) Improvement in the retting of husks by chemical and mechanical methods so as to make it a commercial proposition and at the same time not disrupt the existing village economy. If the cottage character of the industry is departed from and a factory is established even in some central place, it would not be a practical and economic proposition to transport all the husks to such a factory. What would be most desirable is the introduction of some cheap and easy machinery, as ginning in cotton, for removing the tedium and burden of the process from the cottage worker ;

(d) Husk (fresh) should be properly retted so as to produce high grade fibre for converting into yarn for the production of various kinds of manufactured goods ; and

(ii) Methods for improving quality :—

On the point of the improvement of coir yarn the Panel is of opinion that for the present grading should be confined to describing well-defined qualities and to estimating the moisture content and foreign matter content Towards such improvement and with a view to affording finance facilities for the producer, the Travancore Government have sponsored a *Licensed Warehouse Bill*. It is hoped that the Government will immediately follow this by a *Grading Act*. Better prices would be obtained in consuming centres like London and elsewhere, if proper grading is adopted. Without clearly defining grades and without public prices the future even of the most meritorious commodity would be handicapped

4. *Factors in Competition in the Post-war Period.*

(i) From Manufactured goods :—

India should make fuller use of the raw material Whilst the raw product may be used in the importing countries for other uses than in the manufacture of mats and mattings, it is necessary to ascertain the position accurately and take such steps as are necessary and possible to develop the manufacturing industry in the country of production of the raw material At any rate, this should be kept as an objective in the post-war policy for the coir industry.

(a) Ceylon's annual output of coir fibre (mostly bristle fibre is 12 000 tons About 5 000 tons of coir yarn is also produced. Though Ceylon could increase her production of fibre and yarn, still it offers no serious competition to India for the time being.

(b) Jute floor coverings, though in demand and their outpue considerable in Calcutta are no match for coir mattings which art considered susperior due to the wearing and damp-proof qualities.

(c) A possible source of competition in the future would be the floorcoverings made out of sea weeds and grass from China and Japan, not because of any inherent good quality in them but because of cheaper freights. In the 5-year period there is nothing to fear as large areas under grass cultivation in China are now growing food crops but later on the question might be considered.

(ii) From other Raw Materials (or Hard Fibres) :—

(a) *Manila hemp.* In the 5-year period no serious competition need be expected from manila hemp for the reason that the Japanese occupation of the Philippines has converted hemp plantations to agricultural purposes.

(b) *Sisal* from British and Portuguese East Africa and Mexico gives indications of an encouraging supply but as it will have to be diverted for cordage purposes, it will not be a material factor to be reckoned with for at least the next 5 years.

In this connection the possibilities of establishing roperies in Travancore, Cochin, Malabar and Bombay should also be considered with a view to expanding the manufacturing industry in the country and absorbing more of the raw material. The Panel is of opinion that for an economical ropery not merely coir but also otehr fibres such as manila, sisal, hemp and jute should be made readily available. It is desirable that manila and sisal should enter the country duty-free and a tariff imposed on imported rope. India possesses large uncultivated areas, having almost the same climatic conditions as East Africa, suited for

large scale sisal plantations. The damp-resisting quality of this fibre will certainly play an important part not only in the manufacture of Rope and Cordage but also in that of cheap floorcoverings

(c) *Synthetic Fibres.* These may yet come into prominence in the Rope, Cordage and cheap floorcovering industries

Whatever the favourable background for coir in the coming 5 years, serious consideration needs to be given in the 10-or 15-year period in respect of the development of the hard fibres.

(iii) Cheap foreign labour :—

Before the war, labour was paid very low in China and Japan and made to work for long hours and in some cases, the wage rates are reported to be less than that in the coir industry. Although China and Japan were members of I.L.O (International Labour Organisation) sweated labour prevailed in the grass floorcovering industry We can safely expect that this state of affairs will not recur under the U N.O.

5. *Nature of Government Assistance*

(a) Establishment of a co-operative Research Institute with the co-operation and financial assistance of Government for research purposes.

(b) As already mentioned above improvement in marketing methods and legislation for establishment of Licensed Warehouses and grading will result in improvement of the quality of coir yarn. Establishment of Licensed Warehouses will also increase the financial facilities. But this does not suppose Goverment controls for licensing of quality, *et cetesa.* Ethics in trade had better be left to be decided by the organisation of manufacturers and exporters in voluntary association.

(c) The Co-operative Department of the Governments concerned should take an active part in the promotion of Co-operative Societies in connection with spinning and marketing of coir yarn. In an industry in which the unit of production is so small, the presence of middlemen is an inevitable phenomenon. This can be modified by the organisation of Co-operatiove Societies.

(d) Suitable policy which will ensure the fullest utilisation of the raw material in the manufacturing industry to the extent possible should be adopted by the Governments concerned. Nationalisation is uncalled for as private capital is not shy, the coir industry is not a key-industry and it is fundamentally a cottage industry. Matters could be righted by the introduction of co-operative methods and better marketing methods.

(e) Endeavour should be made by Governments concerned to secure a reduction in tariffs in countries importing coir mats and matting. In certains countries (*e.g.* Australia) the import duty on coir mats and mattings is found to be higher than certain other floorcoverings which is a handicap to the coir industry. Governments concerned should endeavour to remove such handicaps.

(Sd.) HUMAYUN MIRZA.

Secretary.

APPENDIX A.
NOTES BY MR. W. GRANT.

Para 29. On re-consideration I consider these estimates even as a target are overstated, particularly outside Cochin and Travancore–

Para 38. (c) In connection with the comparison of rates of freight on coir mats from the Malabar Coast to U. K. and grass floorcoverings from China to U K. is it correct to state that the cost of conveying a bundle of mats from China to U. K is less than the cost from Cochin to U. K. I would question the correctness of this statement.

Para. 43. In connection with the sentence, "This state of affairs will never recur now under the influence of the United Nations Organization and we can safely expect that such sweated labour will not be permitted in future". I consider this a highly doubtful expectation.

Para 54. I suggest that this para be deleted.

Para 60. I query this. The shipper of inferior quality will eventually be forced out of the market

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APPENDIX B,
CHAIRMAN'S COMMENTS ON THE ABOVE.

Para 29. In the 'General Directive to Industrial Panels" it is given that:–

> "In order to assist them to formulate recommendations, panels will be supplied, as far as possible, with factual information prepared by the Panel Secretaries".

The paragraph in question is built up on the factual information and statistical data supplied to the Secretary of the panel by the various Provinces and State Governments As the estimates are closely based upon this information supplied by the various Governments, I wonder how we can question these estimates.

Para 38(c) The statement contained in this paragraph is correct. Hong Kong is a FREE Port; but on the Malabar Coast Ports, through which Coir Mats and Mattings are exported, the Homeward freight rates are controlled by the Conference Lines, In 1935, the rate of freight from the Malabar Coast Ports to London on one hundredweight of Coir Matting Rugs was 8 shillings and the same was the rate from Hong Kong on Grass Mats of the same weight, although an extra distance of over 3, 000 miles has to be covered to London This is evidence of the statement made in paragraph 38 (c). In fact, there have been occasions, when Grass Mats were carried from Hong Kong to London at much lower rates than indicated above owing to competition between different steamship companies operating in a Free Port like Hong Kong. In this connection, I feel bound to quote the following Passage from the Report of the Ceylon Industries Commission:–

> "The subject of transport facilities both internal and external is one deserving the closest attention, as it is of paramount importance in the development of industries. As regards shipping, owing to the policy of the Homeward Conference Lines giving deferred rebates of 10 p. c, the freight charges are kept generally higher than those from other countries. In South Africa and the United States, the principle of deferred rebates has been declared illegal."

This applies equally well to the Coir Mats and Matting industry.

Para 43. Grant considers it highly doubtful whether wecan expect that in future "sweated" labour will not be permitted. This is, no doubt, a matter of opinion. But the trend of World opinion from the time of the establishment of the League of Nations and the International Labour Organization has been to abolish "sweated" labour and raise the standard of living of workers all over the World. Nations, who have been members of the League of Nations have accepted and ratified the various Conventions of the International Labour Organization relating to labour and have taken steps for improving labour conditions. The Atlantic-charter and the ideals, which the United Nations Organization have set before them, provide adequate grounds for holding the view that "sweated" labour, not only in China and Japan, but in all countries of the World will not be permitted to prevail.

Para 54. Technical development in industries is recognised to be one of the means for their improvement. The suggestion made in this paragraph has found favour with industrialists all over India It is one of the complaints in the coir industry especially that people, who have not acquired the requisite qualification mostly on the technical side, enter the field with disastrous results to themselves and to the industry. This opinion has been expressed in a report by a Board of Conciliation of Trade Dispute in the Mats and Matting Industry appointed by the Travancore Government in 1938.

Para 60. It is the experience of those in the Coir Mats and Matting Industry, that complaints regarding quality have been made for a very long time. As yet, the shippers of inferior quality have not been forced out of the market; indeed, their number is growing. Even in regard to the coir yarn shipped, official complaints have been received in regard to the quality. "Prevention is better than cure" would be the best policy.

(Sd.) K. C.KARUNA KARAN

(Chairman).

STATEMENT I

Shipments of Coir Fibre, Coir Yarn, Coir Rope and Coir Mats and Mattings from the Port of Alleppey, Cochin, Calicut and other Malabar Coast Ports.

(Vide paragraph 23 of the Report)

Year 1st July to 30th June	Port	Coir Fibre Cwts.	Coir Yarn Cwts.	Coir Rope Cwts.	Coir Mats and Mattings Cwts.	TOTAL Cwts.	Percentage of Mats or Mattings to total	Percentage of Mats or Matting shipped from Cochin and Alleppey to the total shipped from these ports under all items
1931-32	Alleppey	3,322	314,177	834	324,046	642,379		
	Cochin	1,217	483,921	51,346	36,585	573,069		
	Calicut	680	148,619	23,259	191	172,309		
	Other Malabar Coast Ports	705	12,549	...	..	13,352		
		5,932	958,916	75,439	360,822	1,401,109	25·75	29·55
1932-33	Alleppey	1,814	291,683	228	338,843	632,563		
	Cochin	2,111	668,356	42,228	35,649	888,644		
	Calicut	512	170,316	20,722	344	191,894		
	Other Malabar Coast Ports	...	12,742	...	...	12,742		
		4,437	983,097	63,478	374,836	1,425,848	26·29	30·68
1933-34	Alleppey	2,383	272,797	115	336,342	611,637		
	Cochin	169	603,180	36,581	87,205	727,086		
	Calicut	1,661	199,686	20,378	4	221,726		
	Other Malabar Coast Ports	...	34,809	...	...	34,809		
		4,141	1,110,472	57,071	423,551	1,595,238	26·64	31·60
1934-35	Alleppey	2,588	235,717	234	340,960	579,059		
	Cochin	1,384	637,667	45,329	74,511	756,291		
	Calicut	797	195,190	23,983	...	219,860		
	Other Malabar Coast Ports	...	44,297	...	...	44,297		
		4,769	1,112,181	69,546	415,011	1,601,507	25·93	31·29
1935-36	Alleppey	2,375	216,234	274	347,961	566,844		
	Cochin	4,153	606,104	45,174	108,107	763,538		
	Calicut	1,545	188,092	23,061	62	208,760		
	Other Malabar Coast Ports	...	18,959	...	...	18,959		
		8,073	1,029,389	68,509	456,130	1,558,101	28·68	34·28
1936-37	Alleppey	2,723	216,540	205	413,639	633,107		
	Cochin	3,152	586,040	48,390	107,859	745,641		
	Calicut	1,327	187,907	26,319	62	215,615		
	Other Malabar Coast Ports	...	25,173	...	...	25,173		
		7,202	1,015,660	75,114	521,560	1,619,536	32·19	37·51
1937-38	Alleppey	2,272	190,272	127	301,838	494,449		
	Cochin	2,320	593,166	44,464	124,624	764,574		
	Calicut	1,132	175,055	32,826	30	209,043		
	Other Malabar Coast Ports	...	29,839	...	...	29,839		
		5,664	988,332	77,417	426,492	1,497,905	28·43	33·84
1938-39	Alleppey	6,159	290,454	169	362,636	659,423		
	Cochin	5,823	556,797	47,827	143,189	749,636		
	Calicut	320	201,307	28,385	18,937	249,149		
	Other Malabar Coast Ports	...	16,511	...	...	16,511		
		12,305	1,059,069	76,381	524,776	1,674,721	31·60	36·01
1939-40	Alleppey	11,639	227,694	459	317,583	557,375		
	Cochin	5,329	524,205	37,550	191,465	758,549		
	Calicut	2,949	203,342	34,163	18,274	258,718		
	Other Malabar Coast Ports	...	19,000	...	...	19,000		
		19,857	974,241	92,172	527,272	1,613,642	32·75	38·00
1940-41	Alleppey	1,465	88,749	229	71,675	162,118		
	Cochin	4,254	409,614	41,133	142,199	597,200		
	Calicut	560	62,015	19,649	14,569	96,784		
	Other Malabar Coast Ports	...	13,761	...	...	13,761		
		6,279	554,139	61,011	228,434	849,863	26·88	28·94

STATEMENT II

Distribution of shipments of Coir and Coir Products from Alleppey, Cochin and Calicut for 1937-38 (1st July to 30th June) showing also proportion of off-take by various countries.

(Vide paragraph 27 of the Report)

Destination	Coir Fibre cwts.	Coir Yarn cwts.	Coir Rope cwts.	Coir Mats and Mattings cwts.	Total cwts.	Percentage
United Kingdom ...	2,666	1,34,820	1,929	3,04,749	4,44,164	30·27
Germany	19	1,87,650	...	138	1,87,807	12·79
Belgium	465	56,515	...	1,343	58,323	3·97
Holland	...	1,06,618	...	8,357	1,14,975	7·83
Denmark	...	8,177	...	172	8,349	0·57
Norway	...	5,571	...	1,016	6,587	0·45
Sweden	...	4,392	...	5,258	9,650	0·66
Finland	...	4,743	...	311	5,054	0.34
Poland	...	7,323	...	...	7,323	0·50
France	4	44,196	...	48	44,248	3·01
Portugal	110	24,234	...	...	24,344	1·66
Italy	319	53,602	...	...	53,921	3·67
Malta	...	...	...	407	407	0·03
Greece	172	4,098	...	...	4,270	0·29
Turkey	...	1,914	...	540	2,454	0·17
Persia	...	...	...	1,924	1,924	0·13
Arabia	...	23	...	2,359	2,382	0·16
Africa	46	8,108	75	10,151	18,380	1·25
America	116	31,223	66	26,003	57,408	3·91
Canada	...	945	...	2,681	3,626	0·25
Australia	20	13,891	...	33,122	47,033	3·20
New Zealand	...	...	...	7,988	7,988	0·54
Philippines	...	...	...	346	346	0·02
Japan	...	11,319	...	...	11,319	0·77
China	...	723	37	148	908	0·06
Straits Settlements ...	...	...	60	824	884	0·06
Burma	276	63,902	1,978	1,024	67,180	4·58
Ceylon	...	99	...	601	700	0·05
Other Countries ...	1,421	26,609	11,125	10,248	49,403	3·37
India	30	1,57,798	62,147	6,734	2,26,709	15·44
Total ...	5,664	9,58,493	77,417	4,26,492	14,68,066	100·00

N.B.—Shipments from "other Malabar Coast Ports" are not taken into account.

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AND

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INTRODUCTION

The Government of India in the Department of Planning and Development constituted a Panel to consider and advise them regarding the possibilities of the post-war development of Paper, Board, Pulp and Chemical Cotton Industries. The Panel consisted of the following :—

Chairman :—

Mr. M. L. Narasimiengar.

Members :—

Mr. G. P. Birla.
Mr. M. P. Bhargava.
Dr. A. Schoenberg.
Mr. Jagraj.
Mr. Laiq Ali. (Since Mr. Laiq Ali was out of India for most of the time, Mr. K. Nizamuddin attended the meetings of the Panel on his behalf.)

Secretary.

Mr. A. S. Bhatnagar, Assistant Industrial Adviser.

Mr. C. D. Thakkar was subsequently co-opted as a member of the Panel.

The following general directive was issued by the Government of India to indicate the scope of the Panel and the procedure to be followed by it.

General Directive to Industrial Panels.

1. It is the function of panels to make recommendations to Government regarding the development of industries, both existing and new. These recommendations should be so framed as to enable Government to prepare a detailed phased plan for the five years following the cessation of hostilities, as the first stage of a 15-year plan of industrial development for the whole country.

2. In order to assist them to formulate recommendations, panels will be supplied, as far as possible, with factual information prepared by the panel secretaries. In the case of new industries, the information will consist of a general survey of the industry and the importance of starting it in India, the availability of raw material, the power requirements, the demands of the Indian markets and the probabilities of exports. In the case of existing industries, the information will naturally be more comprehensive; it will indicate in addition, the location of existing units, the types of goods produced, the total production under each category and the assistance, if any given by Government. These items are to be regarded as illustrative and not exhaustive.

Government will give each panel, as a basis for discussion, the provincial target to be aimed at in the first five-year period and, wherever possible, of the target to be reached in 15 years,

3. The recommendations of the panels should cover the following points. :—

(1) The scope and extent of development, including the type of products recommended.

(1-A) The estimated requirements of capital goods together with such details of those requirements as may be available in India and how much should be imported from abroad.

(2) Whether the industry should be under Government ownership either on grounds of national interest or because private capital is unlikely to take it up, and if so, whether it should be wholly or partly managed by Government.

(3) In the case of industries to be develoed other than under State ownership, the capital required for such development, whether the whole of it is likely to be available by public investment and, if not, the extent to which Government assistance may be required.

(4) The extent to which technical advice from abroad may be necessary.

(4-A). The availability and the future requirements of technical personnel so as to obtain a clearer indication of the present shortcomings and future needs.

(5) The manner and the degree of co-operation with foreign firms considered necessary and desirable, both as regards capital and management.

(6) The location of the industry.

(7) The nature of the assistance required from Government in the form of protective duties, bounties, research grant, expert advice, etc.

(7-A). The relative incidence of the import duty on the finished goods in comparison with the duty on the raw materials from which they can be manufactured.

(8) If the industry is to be under private ownership and management, what controls, if any, should be exercised by Government.

(9) What should be the organisation of the different units of the industry, *e.g.*, should there be an industrial association? Would a cartel be desirable?

(10) The stages by which the industry should be developed.

(11) Should the Industry cater for the export market?

(12) Should the industry be developed, as in Japan, on the cottage industry basis and, if so, to what extent?

4. Although, as stated above, the panels may recommend the grant of protection, it will not be their function to consider broad questions of international trade and commercial policy.

5. Joint meetings of the panels should be held, wherever necessary, to secure co-ordination particularly where the processes and the products of one industry are connected with those of another.

6. Some of the panels have been drawn broadly and it may be necessary to co-opt members for dealing with specific branches of the industry. Members may be co-opted by the Chairman in consultation with the Industrial Adviser.

7. Before submitting recommendations, panels should consult Provincial Industrial Committees, particularly in the matter of location of industry. They should also, where the circumstances of the case require it, consult Industrial Committees in States or State Governments bar Durbars. The recommendations should be submitted to Government through the Industrial Adviser.

III. A preliminary note containing factual information about the industry was prepared by the Secretary and was circulated amongst the members of the Panel before its first meeting.

IV. The Panel met on the following dates:—

(*a*) First meeting held on the 24th July, 1945 at New Delhi.

(*b*) Second meeting held on the 5th and 6th September, 1945 at Dehra Dun.

(*c*) Third meeting held on the 7th, 8th and 9th November, 1945 at Calcutta.

(*d*) Fourth meeting held on the 19th and 20th February, 1946 at New Delhi.

(*e*) Fifth meeting held on the 26th and 27th April, 1946 at New Delhi.

(*f*) Joint meeting with representatives of Provincial and State Governments and their Industries Committees held on the 12th July, 1946 at New Delhi.

(*g*) Seventh meeting held on the 19th November, 1946 at New Delhi.

V. The Panel sought the advice of the following persons and representatives of Associations at various stages of its deliberations:—

1. Mr. D. G. Currie, Director of Paper, Directorate General of Supply, New Delhi.
2. Mr. A. A. Whitley, Deputy Controller of Printing and Stationery, Government of India.
3. Mr. Shanti Parshad Jain. — Representatives of Indian Paper Mills Association.
4. Mr. Karam Chand Thapar. — Representatives of Indian Paper Mills Association.
5. Mr. K. C. Kothari. — Representatives of Indian Paper Mills Association.
6. Mr. T. H. Todd, Bengal Paper Mills. — Representatives of Indian Paper Makers Association.
7. Mr. R. C. Webster, Bengal Paper Mills. — Representatives of Indian Paper Makers Association.
8. Mr. R. A. Graham, Bengal Paper Mills. — Representatives of Indian Paper Makers Association.
9. Mr. A. P. Benthall, Titaghur Paper Mills. — Representatives of Indian Paper Makers Association.
10. Mr. E. S. Mitchell, Titaghur Paper Mills. — Representatives of Indian Paper Makers Association.
11. Mr. E. C. Gosh, Titaghur Paper Mills. — Representatives of Indian Paper Makers Association.
12. Mr. Karam Chand Thapar, Shree Gopal Paper Mills. — Representatives of Indian Paper Makers Association.
13. Mr. Sardana, Shree Gopal Paper Mills. — Representatives of Indian Paper Makers Association.
14. Mr. H. N. Chaudhuri, India Paper & Pulp Co. — Representatives of Indian Paper Makers Association.
15. Mr. R. Fraser, India Paper & Pulp Co. — Representatives of Indian Paper Makers Association.

16. Mr. R. K. Murthy, representing Messrs. J. P. Advani, & Co., Bombay.
17. Mr. R. N. Dutt, representing Messrs. Bholanath Dutt & Sons, Calcutta.
18. Mr. D. Y. Athawale, representing Director of Industries, U.P.
19. Mr. T. Venkajee, representing Director of Industries and Commerce, Madras.
20. Mr. Seshadriyengar, representing Director of Industries, Bombay.
21. Mr. D. N. Ghosh. .. } representing Director of Indus-
22. Mr. Khan. .. } tries, Bengal.

The Panel is greatly obliged to these gentlemen and several other officials and non-officials and private concerns (to whom questionnaires were sent from time to time) for their willing help and valued advice. The Panel is also grateful to Mr. D. G. Currie and Mr. M. P. Bhargava for supplying some of the appendices attached to this report.

VI. Grateful thanks of the Panel are also due to the Chairman for his able guidance at the meetings and for his keen interest in the work of the Panel.

VII. The Panel places on record its high appreciation of the valuable services rendered by the Secretary, Mr. A. S. Bhatnagar and his assistants in satisfactorily getting through the work connected with the Panel.

PART I.

Paper and Board Industries.

PAPER INDUSTRIES.

Earlier Developments :—

Hand-made paper has been produced in the country for centuries at a number of centres. With the advent of machine-made paper it has steadily lost importance and the art has gradually faded out.

2. The production of machine-made paper in India dates back to the year 1870, when the first paper mill named Bally Mills was started on the banks of the Hoogly and it is in this neighbourhood that the principal seat of the industry still exists. Bally Mills started with a single machine but in course of time were able to increase the number to four, with an output of over 5,000 tons per annum. Their success was, however not permanent and the company went into liquidation in 1905. Two of their machines were purchased by the Titaghur Paper Mills, which commenced manufacture in 1884 at Titaghur with three machines. During the period 1892-94 a third paper mill known as the Imperial Paper Mills was established on the Hoogly at Kankinara. This venture however, was not successful and ultimately in 1903 the mill was taken over by the Titaghur group. For thirty years after 1892, no new mill sprang up in this area.

In 1922, the Indian Paper Pulp Co. Ltd., formed in 1819, commenced production of paper at Naihati.

3. The oldest of the up-country mills namely the Upper India Couper Paper Mills Ltd., at Lucknow, started manufacture in 1882 with one machine which was duplicated in 1894. Another single machine paper factory was installed at Gwalior in 1881, but was eventually closed down as it could not be run at a profit. In 1922, the machinery was removed to Raniganj (Bengal) and incorporated in the plant of the Bengal Paper Mills Co. Ltd.

4. In 1887 another company, the Deccan Paper Mills Co. Ltd., began the production of paper at Poona. It continued to run for over 30 years till 1924, when it had to be temporarily closed down on account of the general depression in trade. One of the most important of the up-country paper mills is situated at Raniganj and belongs to the Bengal Paper Mills Co. Ltd. This concern was floated in 1889 and started manufacture in 1891.

5. The Indian paper industry struggled hard for survival till the beginning of the World War I. During 1914-18, on account of the curtailment of imports of wood pulp, the industry experienced certain difficulties. The general depression in trade at the end of the war and the dumping of enormous quantities of foreign imports, further worsened the condition of the Indian industry, and a representation was made by the Indian Paper Makers Association, to the Government of India in

June, 1923 for assistance. Later in January, 1924, the Indian Paper Pulp Co. Ltd., asked for protective duty on imported paper. Realising the importance of paper industry and the difficulties it had been experiencing, the Government of India referred its case to the Tariff Board in 1925.

Position of the industry at the time of the first Tariff Board in 1924-25.

6. At the time of the Tariff Board enquiry in 1924-25, there were nine paper mills in India. Of these, the two Titaghur Mills and the Bengal Paper Mills at Raniganj had four machines each. The paper mills at Lucknow had two and the remaining five had one machine each. The annual production capacity of all taken together was estimated at about 33,000 tons per year. Two new mills were projected. The one at Rajahmundry (Madras) had already been partially constructed. This was owned by the Carnatic Paper Mills Ltd. and had an estimated capacity of 1,600 tons a year. The other was projected at Jagadhri (Punjab) by the Punjab Paper Mills Co. Ltd., with an estimated annual capacity of 6,000 tons.

7. In 1925 there was a revenue duty of 15% on all classes of paper. The main raw material used by the Paper mills was *sabai* grass (Eulaliopsis binata). The Tariff Board considered the possibilities of utilising bamboo which was so abundantly available in the country. Experiments on manufacture of bamboo pulp for paper making were very promising. It was therefore suggested by the Board that financial assistance should be offered to the mills prepared to experiment with bamboo pulp. A specific duty of 1 anna per lb. on all types of writing and printing paper, excepting chromo, marble, poster, flint, stereo and newsprint containing 65% or more of mechanical pulp was also recommended.

8. The Government of India rejected the proposal for financial assistance to mills but agreed to the imposition of protective duties on certain classes of paper. The Bamboo Paper Industry (Protection) Act was passed in September, 1925. This provided protection to printing paper (excluding chromo, marble, poster, stereo) of all sorts, containing less than 65% of mechanical pulp and to writing paper of all types including ruled and printed forms and manuscript books. The life of the act was fixed upto 31st March, 1932.

Tariff Board (1927) :—

9. The Act of 1925, did not clearly specify whether the percentage of mechanical pulp should be calculated on the net fibre content of the paper or on its total weight. This point was referred to the Tariff Board in 1927 and as a result of their recommendations an amendment was passed which provided that the percentage of mechanical pulp should be calculated on the net fibre content. The Act was also amended to provide that printing paper containing no mechanical pulp should be liable to the protective duty. In the case of ruled or printed forms (including printed letter paper), account and manuscript books and the binding thereof, if the protective duty was less than the revenue *ad valorem* duty, the *ad valorem* duty was to be levied.

The general *ad valorem* duty at that time was 15%. When the general level of revenue duty was raised from 15 to 20% by the Indian Finance Act, 1931, no change was made in the *ad valorem* protective duty of 15% imposed on writing paper as an alternative to the specific duty of 1 anna per lb. In November, 1931, the Government of India imposed a surcharge of 25% on the existing revenue and protective duties levied on different classes of paper thus raising the specific protective duty to 1 anna 3 pies per lb. and the alternative *ad valorem* duty to 18.3/4%.

Tariff Board (1931) :—

10. As the Act of 1925 was due to lapse on 31st March, 1932, the Government of India again referred the case of the Indian paper industry to the Tariff Board in 1931. By this time the industry had made satisfactory progress. The maximum annual production capacity of the Indian mills in 1931 was estimated at 45,600 tons. There was no change in the number of mills, but the Indian Paper Pulp Co.'s mill at Naihati and the Deccan Paper Mills at Poona, had added one more machine each. Of the projected mills at Rajamundry and Jagadhri (Punjab) the former was working only partially due to lack of capital; while the latter went into liquidation after working for about nine months.

11. The main recommendations of the Board were that the paper industry had justified the protection given to it and that the existing protective duties should continue for a further period of seven years. In order to encourage the development of bamboo pulp a duty of Rs. 45 per ton on imported wood pulp was also proposed. The Government of India accepted the main recommendations of the Board. The Bamboo Paper Industry (Protection) Act of 1932 provided protection for the classes of paper already protected at the existing rates but raised the percentage of mechanical wood pulp in duty free paper from 65 to 70%. A protective duty of Rs. 45 per ton was also imposed on imported pulp. All these duties were subject to the revenue surcharge imposed in November, 1931.

Some changes were made in the Tariff Schedule in consequence of the Ottawa Trade Agreement. The effect of these changes was to raise the standard rate of duty on some classes of paper subject to revenue duty to 30 per cent. with a preferential rate of duty of 20 per cent. for articles which were of British manufacture.

Tariff Board (1935) :—

12. The Tariff Board in 1931 was not satisfied with the classification of writing and printing paper and had suggested examination of the definitions according to trade conventions by a representative conference of all the interests concerned. The Government of India did not accept this proposal but finally in 1935 referred the matter of classification to the Tariff Board. The Board examined many schemes and methods of classification, but found them to be impracticable. They finally decided that the existing scheme was the best as it had the merit of being familiar to the trade and the Customs Department. The main recommendations of this Tariff Board were accepted by the Government

but it was decided to defer the necessary legislation on modifications of the Tariff Schedule.

Tariff Board (1938) :—

13. The most significant advance made by the Indian paper industry during the period 1931 to 1938 was in respect of indigenous pulp production. This was mainly due to the protective duty imposed on imported pulp by the Bamboo Paper Industry (Protection) Act of 1932. The quantity of bamboo pulp used in the Indian mills increased from 5,228 tons in 1931 to 19,281 tons in 1938, of grass pulp from 9,049 tons to 11,500 tons. The increase in pulp manufactured from other indigenous materials was from 5,992 tons to 7,919 tons. The quantity of imported pulp in the same period decreased from 20,081 tons to 10,976 tons. The proportion of imported pulp used by mills decreased from 50% to 20%.

14. The total consumption of paper including boards in India increased from 82,735 tons in 1931-32 to 113,654 tons in 1936-37. The consumption of writing and printing paper increased in the same period from 48,131 tons to 55,204 tons. The output of Indian Mills increased from 40,588 to 48,531 tons. The number of mills increased from 9 in 1931-32 to 10 in 1937-38. In 1937-38 five mills were manufacturing paper from bamboo or bamboo and grass, two from grass and three from rags and wastepaper.

15. On the expiry of the period of protection, the Government of India again referred the case of the Indian paper industry to the Tariff Board in 1938. The Board recommended that the period of protection be extended by seven years from April, 1939. The measure of protection suggested, was to be fixed at 11 pies per lb., 1 pie less than the protective duty recommended by the Tariff Board in 1931 and 4 pies less than the prevailing rate of duty which included a revenue surcharge of 3 pies. The continuance of import duty on imported pulp was recommended at the rate of Rs. 35/- per ton or 25% *ad valorem* whichever was higher. The previous rate of duty plus surcharge was Rs. 56-4-0 per ton.

16. The Government of India accepted the recommendations of the Board with slight modifications. The tariff schedule for paper imports as it stood on 31st March, 1942, is given in Appendix I attached to this report. It has recently been extended to 31st March, 1947.

Present position of the industry :—

17. The progress made by the Indian paper industry during the present war has been rather significant. Paper and board production excluding straw board has increased to 1,03,883 tons in 1944 as compared with 53,811 tons in 1937-38 (Appendix II(*d*)). In spite of the fact that imports of wood pulp have been appreciably curtailed during this war, the Indian industry has improved and increased production with indigenous raw materials,

A comparative statement showing the quantities of raw materials used by the paper industry in 1936-37 and 1944 is given below (*Vide* Appendix IV).

Raw Materials.	1936-37 (tons).	1944 (tons).
1. Bamboo ..	.. 19,281 (pulp)	1,87,000 (bamboo)
2. *Sabai* grass ..	.. 11,510 (,,)	60,086 (*sabai* grass).
3. Wastepaper ..	5,908	17,400
4. Old rags, cloth cuttings, hemp rope etc. ..	8,868	27,328
5. Imported wood pulp ..	10,976	..

18. The number of mills has increased from 10 in 1938 to 16 in 1944 (Appendix VI). During this period, great attention has been paid by Indian paper mills to bringing their pulping and beating processes up to date, thus resulting in an all round improvement in the quality of Indian made paper. Paper machinery valued at Rs. 187.8 lakhs (Appendix V) has been imported during this period. Most of the mills have improved their pulp manufacturing plants and some of them manufacture their own requirements of caustic soda and chlorine. Production of kraft paper has been undertaken by one mill. Special types of paper *e.g.* blotting paper, bank paper etc., are being successfully manufactured by some Indian mills.

Consumption of paper in India:

19. In 1937-38, consumption of all types of paper in India including newsprint was estimated at 2,03,574 tons consisting of 1,49,975 tons of imports supplemented by 53,599 tons of indigenous production. Due to war conditions imports have largely diminished. During this period local production has gone up and in 1943-44 Indian mills produced 99,831 tons of paper and boards excluding straw board. Imports during the same year were about 20,000 tons. Indian production for 1944 has been estimated at about 1,03,883 tons (Appendix II(*a*)). Straw board production in 1944 was estimated at about 14,000 tons.

20. Consumption of printing paper excluding marble, flint, stereo etc., and writing paper was 72,086 tons in 1937-38. In 1942-43, India consumed 66,392 tons consisting of 64,850 tons of local production (Appendix II (*e*)) supplemented by only 1,542 tons of imports. In 1937-38 the consumption comprised of 47,798 tons of local production (Appendix II(*d*)) and 24,288 tons of imports (Appendix V(*a*)).

21. Wrapping papers including kraft, imitation kraft, manilla, oiled and waxed etc., were mostly imported before the Second World War. In 1937-38 consumption of wrapping papers in India was 29,041 tons out of which 3,521 tons were contributed by local production (Appendix II(*d*)). Imports were 25,520 tons valued at Rs. 83.8 lakhs (Appendix II(*e*)). In 1942-43 Indian production was 16,984 tons (Appendix II(*e*)) which was supplemented by only 2,148 tons of imports.

22. Consumption of blotting paper, other kind of paper and paper manufactures in 1937-38 was 7,902 tons. Indigenous production was 2,280 tons (Appendix II(*d*)). Imports were 5,622 tons (Appendix V(*d*)) valued at Rs. 42.6 lakhs. In 1942-43 imports were only 2,272 tons.

23. Besides the above, India was annually consuming on an average 38,000 tons of newsprint which came mainly from Sweden, Norway, Canada and United Kingdom. In 1935-36, 34,327 tons valued at Rs. 52.4 lakhs were imported. The maximum imports were in 1937-38 when 43,245 tons valued at Rs. 78.7 lakhs were imported. The imports in 1943-44 were 13,777 tons costing Rs. 45.7 lakhs. (Appendix V(*b*)). No newsprint has ever been manufactured in India.

24. Some quantities of litho, poster and other special types of paper were also imported into India. In 1937-38 imports were 2,486 tons valued at Rs. 8.7 lakhs.

25. Old newspapers in bales found a large market in India. They were used for packing sweetmeats, provisions and other foodstuffs. Imports were mainly from United Kingdom and U.S.A. and were on an average, 48,000 tons per year in pre-war days. In 1935-36, 57,583 tons (Appendix V(*c*)) valued at Rs. 41.6 lakhs were imported. In 1937-38, the imports were 48,809 tons and in 1942-43 they fell to 1,119 tons valued at Rs. 2.9 lakhs.

Paper Control:—

26. To organise production in the paper mills and to ensure continuous supplies for defence requirements, the entire production of the Indian paper mills was put under control in 1942 and a Paper Production Commissioner was appointed to enforce the control. This measure was considered necessary because imports had gone down appreciably and the entire defence requirements, which had greatly increased, had to be met from indigenous production. The control order allowed 70% of the total production for Government use, including military requirements, and the remaining for essential civilian requirements. There was an acute shortage of paper in the civil market, and universities and other educational institutions suffered in consequence. During the years 1942 and 1943, the paper problem became rather serious and arrangements were made to import large quantities of paper from America under lend-lease arrangements. Government assisted the paper mills with raw materials, coal, railway transport, etc., in order to get maximum production. In 1944, the development of paper production was taken over by the Supply Department and a separate Paper Directorate was formed. Later, conditions became steadier, and the quota for essential civil requirements has been increased to 70%.

27. During this war, the position with regard to newsprint has also been serious. From 43,245 tons imported in 1937-38, the imports decreased to 13,777 tons in 1943-44. Besides increased newspaper requirements, Government consumed a substantial quantity for publicity work. The result was an acute shortage for civilian requirements. A Newsprint Controller was appointed and strictly rationed quantities of newsprint were supplied to newspapers. Sizes of newspapers were reduced and the number of pages was decreased. A number of small newspapers and periodicals had to cease publication and a large number of printing presses were hard hit. Due to this acute shortage of paper, a large inherent demand for paper in the country has remained

unsatisfied. As normal conditions return, the Indian industry will have to meet this unsatisfied demand.

Location of present units:--

28. The principal seat of the Indian paper industry is in the Hoogly District in Bengal. It is in this area that the first paper mill was established in 1870. While Bengal produces more than 50% of the total Indian production of paper, the various mills are more or less evenly distributed throughout the country. The existing paper mills are located at the following places:—

	Name of Province or Indian State.	*No. of mills.*	*Site of paper mill.*
1.	Bengal ..	4	1. Kankinara. 2. Titaghur. 3. Raniganj. 4. Naihati.
2.	Orissa ..	1	1. Brajrajnagar, (Sambhalpur Distt.)
3.	Bihar ..	1	1. Dalmianagar (near Dehri-on-Sone).
4.	Bombay ..	3	1. Poona. 2. Bombay. 3. Ahmedabad.
5.	United Provinces ..	2	1. Lucknow. 2. Saharanpur.
6.	Punjab ..	1	1. Jagadhri, (Ambala District).
7.	Madras ..	1	1. Rajamundry.
8.	Hyderabad State ..	1	1. Sirpur-Kaghaznagar.
9.	Mysore State ..	1	1. Bhadravati.
10.	Travancore State ..	1	1. Punalur.

Raw Materials.

Bamboo:—

29. The main raw materials used by the Indian paper mills are bamboo and *sabai* grass. Abundant supplies of bamboo are available in Assam, Bengal, Bihar, Orissa, Central Provinces, Mysore, Bombay, Madras, Hyderabad and Travancore. One great advantage that bamboo scores over conifers is that is a two to five yearly crop while the soft woods take forty to sixty years before they become suitable for use as pulp wood. This assures the Indian Industry of a regular and continued supply of the basic raw material besides preserving the timber resources of the country for more important uses.

30. Of the various species of bamboo which grow abundantly in the country and have been found useful for pulp manufacture, the *eta* (Ochlandra-brandisii) variety grown in Tranvancore State has been found

to be the best. Other varieties include *muli* (Melocanna bambusoides), *daba* (Bambusa arundinacea), *saliya* (Dendrocalamus strictus) etc. The Panel feels that the Provincial Forest Departments should make efforts to grow bamboo as a commercial crop, so that the paper industry may be assured of continuous and regular supplies.

Grass :—

31. One other indigenous raw material which has gained prominence especially in the Indian paper industry is *sabai* grass. It grows chiefly in the Punjab, the United Provinces, Bihar, Orissa and Nepal State. Experiments conducted by the United Provinces, the Punjab and Bengal Forest Departments, have established that *sabai* grass can be grown as a commercial crop on waste land. The Panel suggests that experiments should be conducted to grow other grasses and wood, suitable for making pulp, on a commercial scale.

32. Whereas it has become an established fact now, that bamboo will be the principal material for paper manufacture in India, the use of grass as a constitutent for paper manufacture has recognised value. It will continue to be used in conjunction with other materials as a necessary ingredient in the manufacture of paper. It may be substituted by bamboo in certain areas, but in the United Provinces and the Punjab, where adequate supplies of bamboo are not available, *sabai* grass will continue to be the chief raw material for the paper industry.

Bagasse :—

33. Another promising material which presents bright prospects for use as pulp especially in the manufacture of cheap quality papers and boards, etc. is bagasse. In foreign countries it has been put to a variety of uses. In India large quantities of bagasse may become available with sugar mills every year which can be used for pulp manufacture.

Wood Pulp :—

34. The manufacture of wood pulp has never been attempted in this country on the ground that soft woods are not available in India at economic prices. Abundant supplies of spruce and fire wood are known to exist in the north Himalayan region (Kashmir, Tehri Garhwal and the Punjab forests). No systematic effort has ever been made by the forest departments to explore the possibilities of their economic transport to the plains and their commercial utilisation. Once this is made possible, the manufacture of both chemical and mechanical pulp suitable for either rayon or newsprint will be possible in India. The Panel strongly recommends that immediate steps should be taken in this direction.

35. Besides the above mentioned raw materials, there are abundant supplies of other cellulose bearing materials such as hemp, reeds, cotton waste, cotton linters etc. More extensive research should be carried out to explore the possibilities of their use in paper, board and other industries.

36. It can therefore be seen that India is very favourably placed with regard to the basic raw materials used for paper manufacture. Authoritative statistical data about the total quantities of these raw

materials grown in different areas is however, not available. The Panel, therefore, strongly recommends that the Government should arrange for the carrying out of an immediate survey of all cellulosic raw materials including soft and hard woods, bamboo, grass, other reeds, cotton linters, cotton wastes etc., available in the country. The survey should be carried out by the Agriculture Department, Government of India, who should appoint special officers in the different regions for collection of statistical data and should be given a special grant for this purpose. For carrying out this survey priority should be given to those regions where the location of new units is indicated by the Panel.

37. Besides bamboo and *sabai* grass, wastepaper and paper cuttings are also used as ingredients in the manufacture of cheaper qualities of paper. Rags and cloth cuttings are utilised for superior qualities. The collection is made through contractors mainly from large towns. During 1944, the paper industry used about 17,400 tons of wastepaper, 19,950 tons of old rags, tailors cuttings etc., and 7,373 tons of hemp. (Appendix IV).

Manufacture of pulp from waste materials :—

38. The manufacture of pulp from waste materials like old rags, and wastepaper has not received as much attention in this country as it deserves. In the United Kingdom and other industrially advanced countries, the collection of waste materials is a highly organised business and scrap collection depots exist in every corner. There is a large range of recognised qualities for which regular price quotations are published. During World War II there was a mass drive for scrap collection in England. This proved very useful and many factories were fed from scrap raw materials. On a much smaller scale the same scheme was initiated in some cities in India and a number of scrap collection committees were formed and scrap depots were opened. It is suggested that in the post-war period, the scrap collection agencies and depots should be retained, as these constitute potential sources of raw materials for many industries. The entire scheme should be organised on systematic lines with the co-operation of the industries concerned.

Chemicals :—

39. The following chemicals are generally used by the paper industry :—

1. Caustic soda.	2. Magnesite.	3. Sulphur.
4. Sodium silicate.	5. Soda ash.	6. Hydrochloric acid.
7. Sodium sulphide.	8. Lime.	9. Bleaching powder.
10. Sulphuric acid.	11. China clay.	12. Rosin.
13. Alum ferric.	14. Glue.	15. Casein.
16. Starch.	17. Dyes.	18. Potassium ferro-cyanide.
19. Aluminium sulphate.	20. Salt cake.	
	21. Sodium chloride.	

The quantities of different chemicals used by the Indian paper industry in 1944 are given in Appendix IV attached to this report.

Power requirements :—

40. The problem of supplying cheap power for the industry is of great importance. About 3 to 4 tons of coal are needed for the manufacture of one ton of paper (pulp and paper). Most of the Indian paper mills are worked on electric power generated at the factories. In course of time some of the mills will switch on to hydroelectric power, wherever it is available, thereby effecting economy in coal consumption. The Mysore Paper Mills Ltd., in Mysore State and the Punalur Paper Mills Ltd., in Travancore State are already using hydroelectric power. The quantity of coal used by paper mills in 1944 was .345 million tons (Appendix IV). Calculating on the average basis of 3.5 tons of coal per ton of paper, it is estimated that the industry will require in 1951 and 1956, .66 million tons and 1.19 million tons of coal respectively. These quantities will appreciably decrease with the advent of cheap hydroelectric power.

Labour employed in Indian paper mills :—

41. The labour required by the Indian paper industry can be classified under two heads, the labour employed in the collection of primary materials such as bamboo and grass and the labour employed in the manufacture of pulp and paper. There appears to be no difficulty in obtaining sufficient Indian labour of either class. No figures are available as to the labour employed in the collection of raw materials as this work is mainly done through contractors. A statement giving the average number of daily workers employed by the paper industry in different years is given below :—

Years.	Average No. of daily workers employed.
1931-32	6,025
1933-34	6,141
1936-37	7,037
1942-43	15,280
1945	17,629

Future expansion of the industry :—

42. The per capita consumption of paper in India was only 1 lb. in 1939 as compared to 152 lbs. in U.K. and 174.4 lbs. in the United States of America in 1935 and 174.7 lbs. in Canada in 1937. The consumption of paper is largest in the U.S.A. and the per capita consumption in that country in 1941 was about 300 lbs. The low consumption of paper in India in the past can largely be attributed to the poor literacy standard. With the growth of literacy, expansion of commerce and industry and the general rise in the standard of living, the consumption of paper bids fair to increase rapidly in the future.

43. The post-war expansion of every industry in India is closely linked up with the early procurement of capital goods from abroad. Due to the complete stoppage of imports during the war and the abnormal demands of the military and other Government departments the Indian paper and board industries have been working under great stress. The result has been that most of the machines require either replacement or immediate repairs. The Panel considered a number of quotations for paper machinery received by the members from foreign manufacturers. In every case, the period of delivery quoted was not less than two to three years. Therefore the Panel feels that no new mill will be able to start production before 1950. It may however be possible for the existing mills to replace and replenish their plants within the next two or three years.

44. In view of the above difficulties, the Panel feels that the post-war development of paper and board industries should be spread over a period of ten years ending 1956, and should consist of two stages. The first stage of expansion in production should be achieved during the first five years ending 1951 and the second stage should be reached in the succeeding five years ending 1956. The Panel, therefore, recommends the following post-war consumption and production targets for the paper industry :—

Anticipated consumption.

Type of product.	Anticipated annual consumption in 1951 (tons).	Anticipated annual consumption in 1956 (tons.)
1. Writing and printing paper including art, chromo, stereo, badami etc. ..	1,25,000	2,00,000
2. Cheap wrapping paper including old newspapers	60,000	60,000
3. Kraft paper	20,000	40,000
4. Sand-paper	7,000	10,000
5. Grease-proof paper including vegetable parchment etc.	2,000	4,000
6. Miscellaneous types excluding cellophane..	6,000	8,000
7. Newsprint	60,000	1,00,000
Total paper ..	2,80,000	4,22,000

Anticipated indigenous production.

Type of product.	App. present indigenous production (tons.)	Anticipated annual indigenous production in (tons).		Balance to be met by imports in (tons).	
		1951	1956	1951	1956
1. Writing and printing paper, including art, chromo, stereo, badami, etc.	75,000	1,10,000	2,00,000	15,000	*Nil.*
2. Cheap wrapping paper ..	*Nil.*	24,000	50,000	36,000	10,000
3. Kraft paper	10,000	20,000	40,000	*Nil.*	*Nil.*
4. Sand-paper ..	Very small	7,000	10,000	*Nil.*	*Nil.*
5. Grease-proof including vegetable parchment, etc. ..	*Nil.*	2,000	4,000	*Nil.*	*Nil.*
6. Miscellaneous types excluding cellophane* ..	2,500	6,000	8,000	*Nil.*	*Nil.*
7. Newsprint ..	*Nil.*	20,000	40,000	40,000	60,000
Total ..	..	1,89,000	3,52,000	91,000	70,000

*Include match paper, teleprinter, toilet, target, cigarette, tissue paper, etc.

Writing and printing paper including art, chromo, stereo, badami, etc:—

45. The Panel is of the opinion that the entire demand for writing and printing paper should be met by indigenous production. In the initial stages due to lack of special plants, technical personnel and research facilities, it may however be necessary to import about 15,000 tons per annum of special types of paper such as chromo, stereo etc.

46. To make education popular and bring it within the reach of the masses, it is necessary that the price of printing and writing paper should be brought down. The Panel, therefore, recommends that the production of cheap printing and writing paper midway between the present quality and newsprint quality should be encouraged and developed.

Cheap wrapping paper including old newspapers :—

47. In the pre-war period, about 48,000 tons of baled old newspapers were imported into India every year, and found their way into the Indian markets where they were extensively used for packing sweetmeats, provisions etc. This use is most unhygienic and should be discouraged. The Panel strongly feels that Indian paper mills should be encouraged to produce cheap unbleached wrapping paper from bagasse, straw etc., to replace the imports of baled old news papers in the post-war period. It may not be possible for the Indian mills to produce the stuff at competitive rate in the initial stages. It is therefore suggested that some sort of Government help either in the form of protection or as a subsidy should be provided to encourage the production of cheap wrapping paper. Further research work on this problem should also be undertaken at the proposed research centre at Dehra Dun.

Kraft paper :—

48. Kraft paper is a packing paper of special strength manufactured by the sulphate process. Before the war kraft paper was mainly imported from Scandinavian countries. In 1937-38 imports amounted to 13,804 tons valued at Rs. 39 lakhs (Appendix V(*e*)). During the present war, the Orient Paper Mills have started the production of kraft paper. The Panel is of the opinion that kraft paper of the imported quality can be successfully manufactured in India. During the next ten years additional production of 30,000 tons of kraft paper annually is recommended.

Sand-paper :—

49. In the pre-war days sand-paper was imported partly from United Kingdom but mainly from Italy. With the general development of industries, consumption of sand-paper is bound to increase. At present there are a few small factories producing sand-paper in India, with estimated total daily capacity of about 8 tons of the finished product.

Grease proof paper including vegetable parchment etc. :—

50. Before the war grease proof paper was all imported from abroad. Imports in 1938-39 were 1,319 tons value at 5.5 lakhs. The demand for this class of paper is bound to increase in the post-war period and steps should therefore be taken to develop its manufacture.

Miscellaneous types excluding cellophane :—

51. This class includes such papers as match paper, teleprinter, toilet, target, blotting, cigarette, tissue etc. Certain quantities of blotting paper have been manufactured in the country. The Panel is of the opinion that the manufacture of these types of paper should be undertaken as adjuncts to existing or proposed factories.

Newsprint :—

52. The Panel strongly feels that it is most essential that India should not remain dependent upon foreign supplies for newsprint, which is a vital commodity of national importance. Due to the stoppage of imports during this war, there was an acute shortage of newsprint in

the country. Even with the cessation of hostilities the position has not improved. It is learnt that a mission on behalf of the Indian newspapers and with the co-operation of the Government of India has gone to England, U.S.A. and Canada to arrange for newsprint supplies for India. The Panel considers this to be an extremely unsatisfactory state of affairs, especially when the basic raw materials *i.e.*, the soft woods are abundantly available in the Tehri Garhwal, Kashmir and the Punjab forests. If a serious attempt is made by the Government to explore the possibilities of their commercial exploitation and economic transport to the sites of the factories in the plains, the problem of newsprint manufacture can be successfully solved. The Panel feels that it may be necessary for the Government to offer some sort of subsidy, in the initial stages, for the development of this industry. It is hoped that private enterprise will be coming forward to take up this industry provided Government assistance and help either in the form of subsidy or protection is assured. The Panel however feels that in case private capital is not forthcoming to start this industry, the Government should themselves take up newsprint manufacture in the immediate post-war period. With the rise in literacy in the post-war period the demand for newspapers is bound to increase. The Panel visualises an increase of about 60,000 tons per annum over the pre-war annual imports which amounted to about 38,000 tons (Appendix V(*b*)), during the first ten post-war years. It is interesting to note that the Sirpur Paper Mills, Hyderabad have successfully experimented upon the use of a locally available wood for newsprint manufacture and are now planning to instal a newsprint mill.

Future location of the industry :—

53. For the successful working of any industrial venture the selection of a suitable site is of primary importance. For paper and board mills the selection of a site is influenced principally by the following factors :—

(*i*) Availability of raw materials.

(*ii*) Cheap power and cheap fuel.

(*iii*) Abundant supply of water (approximately 1,00,000 gallons of clean, fresh and soft water are required for 1 ton of paper).

(*iv*) Transport facilities.

(*v*) Availability of cheap and efficient labour.

(*vi*) Proximity to consuming markets.

54. Regionalisation of industry is the watchword of economic planning. Undue concentration of industry is undesirable as much from the point of view of balanced and planned economic development as for strategical reasons. In view of the fact that Bengal produces more than 50% of the total paper produced in the country, the Panel is of the opinion that the setting up of new paper mills or expansion of the existing mills to manufacture the same varieties of paper as are being produced there now should be discouraged.

55. Regarding location of new units for different varieties of paper the Panel makes the following recommendations:—

(*a*) Writing and printing paper including cheap quality writing and printing paper as mentioned in paragraph 46.

One economic unit each with annual production capacity of 8,000 tons for the following Provinces and States:—

1. Madras.	2. Bombay.	3. Assam.
4. Punjab.	5. United Provinces.	6. Central Provinces and Berar.
7. Bihar.	8. Central India State.	9. Rewa State.
10. Eastern States Agency or Orissa.		

(*b*) *Cheap wrapping paper*:—6 units each of 5,000 tons annual production capacity producing light weight cheap wrapping paper and 2 units each of 10,000 tons annual production capacity producing heavy weight cheap wrapping paper.

One unit each for the following Provinces and States:—

1. United Provinces.	2. Bihar.	3. Bengal.
4. Bombay.	5. Madras.	6. Sind.
7. Punjab.	8. Central Provinces and Berar.	

(*c*) *Kraft paper*:—

One unit each of 10,000 tons annual production capacity for the following Provinces and States:—

1. Bombay. 2. Central Provinces and Berar. 3. Orissa.

(*d*) *Newsprint*:—

An economic unit is one producing 20,000 tons of newsprint per year.

Newsprint mills can with advantage be located in the following Provinces and States:—

1. Hyderabad State. 2. Punjab or Kashmir State.
3. United Provinces or Tehri Garhwal State.

Sizes of units:—

56. The Panel is of the opinion that a minimum economic unit, under Indian conditions for manufacturing ordinary classes of paper is one producing 8,000 tons of paper per annum. It is therefore felt that existing paper mills below this capacity should be encouraged to expand their production to this figure. The Panel recommends that 40,000 to 50,000 tons of the projected expansion of paper other than newsprint should be allocated for the expansion of the existing mills and the remaining for new mills.

Future requirements of chemicals:—

57. The quantities of different chemicals which will be required by the Indian paper industry in 1951 and 1956 are given in Appendix III attached to this report.

Capital goods requirements :—

58. To meet large war and essential civilian demands, the Indian paper and board industries have, during the present war, been working under great stress and strain. Production has been raised by working the factories overtime and over capacity. This has resulted in the wearing out of most of the machines, which require immediate replacement. Besides, new plants are needed to meet increased post-war requirements. Plants for pulp and paper manufacture incorporating the latest improvements will be required by the paper mills. The Panel, therefore, strongly urges upon the Government to grant all facilities for the early import of capital goods for these industries. At present the choice of the Indian buyers is restricted to British manufacturers only, who are quoting high prices. The Panel also feels that as long as the present restrictions on exchange prevail, it may not be an easy affair for the Indian industrialists to obtain supplies of capital goods from the United States of America and other countries and therefore the Panel wishes to urge upon the Government the necessity of relaxing these restrictions at as early a date as possible in order that plants and equipment may be obtained in free and competitive market.

59. Calculating on the basis of prevailing quotations for machinery, the Panel is of the opinion that capital goods worth about Rs. 10 crores will be required by the Indian paper and board industries during the next five year period.

60. The Panel recommends that the prospects of manufacturing paper, pulp and board machinery in India should be thoroughly explored and attempts should be made to manufacture these in the country. Costs of production in mills have gone up considerably and the continuity of operations has been jeopardised owing to difficulties in obtaining essential stores and spare parts such as, felts, machine wires, carbon rods, rolls, etc. Dependence on external sources for the supply of these essential materials should be minimised and ultimately eliminated. In planning a large scale development of the Paper Industry, it seems essential that due regard is paid to the development of subsidiary industries which ensure a steady supply of these stores and spares which are so essential for maintenance. Even though we will have to depend for some time to come on foreign countries for procuring the capital goods and equipment required for the expansion of existing mills and erection of new ones, dependence on other countries for supplies of simple but essential stores and spares like those enumerated above is a reproach as well as a weakness which we should lose no time to remedy.

Protection :—

61. The Panel is of the opinion that protection to paper industry will be necessary to safeguard the industry against keen foreign competition in the post-war period. Owing to unsettled conditions in foreign countries and shipping difficulties, foreign competition in paper industry is practically non-existant at the present moment. It is however quite possible that in the near future when normal conditions revert and

peace time production abroad is well advanced, foreign countries particularly U.K., Norway and Sweden will endeavour to capture their pre-war export markets including India. Owing to several factors such as higher prices of raw materials, chemicals, machinery, stores etc., higher transport charges, comparatively lower efficiency of Indian mills, smaller sizes of units etc., it may not be possible for the industry to effectively compete in the initial stages with foreign products. The Panel therefore recommends that the present protection afforded to the Indian paper industry should be continued and the scope of protection should be extended so as to include varieties of paper and boards that remain unprotected at present. The degree and form of protection for different classes of paper and boards should be reviewed by the Tariff Board at an early date. This measure will not only create confidence in the minds of the existing millowners but will provide an incentive for the prospective industrialists who wish to start these industries.

Government assistance :—

62. To assist the growth of the industry, the Panel is of the opinion that the Government should adopt a favourable railway rates policy by extending concessions in the freight for the movement of raw materials required by the industry and of the finished products.

Ownership of industry :—

63. The Panel is of the opinion that the paper and board industries should be owned by private enterprise except in the case of newsprint manufacture, where it is suggested that the Government should themselves take up the project in case private capital is not forthcoming in spite of Government subsidy or any other form of assistance. The Panel feels that the entire capital required for the expansion of these industries will be available from the public and no financial assistance from the Government will be needed.

64. The Panel is of the opinion that no foreign co-operation both as regards capital and management is necessary for these industries. Foreign technical advice and skill will be required on short-term contract basis for the development of special types of paper such as teleprinter, toilet, match, cigarette, tissue etc.

Possibility of using bamboo pulp for rayon manufacture :—

65. The Rayon Panel has recommended the early establishment of six or seven rayon factories producing 60 to 70 tons of rayon yarn per day. The Rayon Panel feels that bamboo pulp of certain special specifications can be successfully used for the manufacture of rayon. The technical details of the process have not yet been worked out and considerable research is required to standardise the pulp. If this problem is successfully solved, the Indian paper and pulp industry can help the rayon factories by manufacturing the pulp for rayon. The Panel is of the opinion that it will be distinctly advantageous and economical for the Indian rayon industry to obtain their requirements of pulp from the paper and pulp mills provided the locations of the two factories can be suitably adjusted.

Possibility of developing export trade in bamboo pulp :—

66. The possibility of exporting bamboo pulp was not explored in the pre-war days as Indian mills were not able to produce sufficient pulp to meet their own requirements. The position has changed now. A material reduction has been made in the cost of production of bamboo pulp and the world prices of wood pulp have risen to a level at which there is a possibility of bamboo pulp competing with it favourably. A market for Indian bamboo pulp can be created in the neighbouring countries such as Afghanistan, Australia, Ceylon, Egypt, South East Asia etc. The Panel however feels that export trade should only be allowed after the requirements of the Indian factories are completely met with from indigenous production.

Specialisation and efficiency controls :—

67. The Panel is of the opinion that rationalisation and specialisation is specific products by paper mills is bound to result in increased efficiency and low cost of production. Measures should also be taken for control of scientific and technical efficiency in mills as the existence of inefficient and economic units is prejudicial to the sound development of the industry. It is understood that the Paper Pulp Section of the Forest Research Institute, Dehra Dun have, already taken steps in this direction and an advisory committee consisting of representatives of the trade and Government nominees has been formed. This committee should be reorganised in conformity with the recommendations made in paragraph 70 of this report. The standardisation of products of the paper and board industries is very essential and as far as possible uniform standards for the different varieties should be maintained over the entire industry in the country.

Hand-made paper :—

68. The hand-made paper industry has existed in India for centuries. Before the advent of machine made paper, it was a flourishing trade and was the hereditary monopoly of a large number of families in many parts of the country. The superior and cheap machine made paper gave it a great set back, and during the course of the last fifty years the industry has gradually faded out. The present methods of production are primitive. The raw materials used are mainly wastepaper and to a small extent hemp, jute, etc.

69. In an agricultural country like India where there is a forced period of unemployment for the farmers, the establishment of cottage industries is essential. The Panel has carefully considered the question of developing the hand-made paper industry and is of the opinion that the production of hand-made paper in India should be expanded by organising the industry on systematic lines for the manufacture of special types of paper *e.g.*, filter paper, currency paper, document paper, etc. The crude methods now used, should be improved by introducing semi-mechanisation in the process of manufacture. The Provincial Governments should organise special centres for training and provide machines suitable for the purpose on easy terms of payment. They may also purchase

a portion of their requirements of paper from this industry. This will provide an impetus to the industry and more people will be drawn into the trade.

Research :—

70. It is an established fact that the development and expansion of any industry depends upon efficient economic and scientific research. Many important technical problems of the paper industry have been successfully investigated at the Paper Pulp Section of the Forest Research Institute, Dehra Dun. The Panel feels that the staff and budget at its disposal is wholly inadequate to tackle larger research problems of the industry. The Panel, therefore, strongly recommends that this Research Section should be reorganised into a Pulp and Paper Research Centre at the Forest Research Institute. Fundamental and technical research connected with pulp, paper and board industries should be undertaken at this Centre and the utilisation of pulp for other consuming industries such as rayon, plastics, explosives, etc., should be undertaken at another suitable Centre. Both the Centres should however be under common advisory control. This should also serve as a training centre for training superior technical personnel for the paper and board mills. It is, suggested that complete statistics regarding production, availability of raw materials etc. should be maintained at the Dehra Dun Centre. An economic and statistical section under a capable officer will also be essential. The entire scheme should be worked out by a committee of experts. The Panel recommends that a sum of Rs. 20 lakhs should be allocated by the Government towards the capital cost of the Dehra Dun Centre. The Panel feels that the recurring budget of this Centre should be shared by the Government and the industry. A statutory committee as mentioned in paragraph 72 consisting of representatives of Government and Industry should be constituted to guide the work and progress of the proposed Centres.

Technical training :—

71. The need for having qualified technical personnel cannot be denied. The Panel strongly recommends that in addition to the technicians trained at the proposed Dehra Dun Centre, the Government should send abroad a number of young Indians (at least six) every year for higher training in pulp, paper and board technology.

Statutory committee :—

72. In order to foster the growth and development of the Indian paper and board industries a statutory committee on the same lines as the Indian Central Cotton Committee should be constituted.

Industrial delegation :—

73. The Panel recommends that the Government should afford all facilities to a delegation of industrialists, connected with the Indian paper and board industries, for visiting foreign countries to study t latest developments.

Board Manufacture.

74. Boards are largely used for packing. In the pre-war days more than 70% of the board consumption in India was utilised by the textile industry. The shoe industry took up a major share of the remaining consumption. Packing of cigarettes, medicines, hair oils, toilet requisites, etc., constituted other important uses. In almost every type of packing, boards in one form or the other make their use indispensable. Special types of boards known as ammunition boards are finding increasing use in the manufacture of cartridge washers.

Consumption of boards in India :—

75. Board manufacture was unknown in this country till about 1932, when the first straw-board factory commenced production in Saharanpur (U.P.). Before 1932 India's entire demands of boards were being met by imports. Total imports in 1930-31 were 15,423 tons valued at Rs. 26 lakhs. In 1934-35 the imports increased to 20,847 tons valued at Rs. 33 lakhs, (Appendix VII). In 1937-38, imports were 31,683 tons valued at Rs. 55 lakhs. In 1942-43 due to war conditions the imports fell to 2,655 tons valued at Rs. 17 lakhs. The imports of straw-board were 11,910 tons in 1930-31, and 17,044 tons in 1937-38. Other types of boards were 3,260 tons in 1930-31, and 13,462 tons in 1937-38. Manufacture of boxes, etc. from boards totalled 253 tons in 1930-31 and 1,177 in 1937-38.

76. Paste-boards, mill boards and other boards of all sorts are subject to a revenue duty of 30 per cent. *ad valorem* with a preferential rate of 25% for British manufacture. Imports were mainly from Sweden, Germany, Netherlands, United Kingdom, Finland, Austria, Norway and Belgium. Straw-board is subject to a revenue duty of 20% *ad valorem*. Imports were mainly from Japan and the Netherlands.

Board production in India.

Straw-board :—

77. Through the pioneering efforts of an enterprising Punjab industrialist, the first straw-board factory known as the Punjab Straw-Board Manufacturing Co. was started at Saharanpur (U.P.) in 1930. Actual production commenced in 1932. The plant imported was of German make. In the early stages numerous difficulties were encountered, the chief being the keen competition with cheap Japanese straw-board which was being sold at Rs. 4-6-0 per cwt., at Indian ports. It was however possible for the Indian manufacturers to compete with the Japanese product at the ports, although the margin of profit earned was very low in the initial stages. The Saharanpur factory passed through hard times but managed to keep up its existence. Steadily cutting down production costs and utilising cheaper raw materials, the production was increased and in 1941 maximum production of 5,600 tons was reached. The Indian product was well received in the market and was in all respects superior to the imported variety. The local production of straw-board in 1937 was about 8,000 tons. The Saharanpur factory produced 4,321 tons and the other two small mills in Bengal about 3,500 tons.

78. The success of the Saharanpur concern led other industrialists into the trade and a number of board mills were established in the country. The important factories manufacturing straw-board are :—

1. Punjab Straw-Board Manufacturing Co., Saharanpur.
2. Straw Products, Bhopal.
3. Jaswant Straw-Board Mills, Meerut.

A number of small factories such as the straw-board mills in Billimora (Bombay) and in Rewa State are also manufacturing small quantities of straw-board.

Other boards :—

79. Besides straw-board, other qualities of boards such as duplex, triplex, card, ticket etc. are also manufactured in the country. Messrs. Rohtas Industries, Dalmianagar (Bihar) are the largest producers of other quality boards. They have a plant with an annual production capacity of 10,000 tons. The Orient Paper Mills in Orissa and the Upper India Couper Paper Mills at Lucknow also manufacture boards, the latter specialise in the manufacture of corrugated and paste-boards. A number of other smaller factories manufacturing boards have also sprung up during this war but their production is insignificant.

80. The total present potential capacity of all the board mills in India is about 48,000 tons per annum (Appendix VIII). A number of the existing board mills have locally fabricated plants which are also uneconomic units. It therefore seems very doubtful if these mills will be able to withstand competition in the post-war period. The chief centres of board consumption in India are Calcutta, Bombay, Ahmedabad, Agra, Cawnpore and Delhi.

Raw materials :—

81. The chief raw material for straw-board is wheat straw although bagasse and rice husks have also been used with advantage. Other types of boards such as cardboard, duplex, triplex and glazed boards etc., require higher percentages of cellulose. Old rags, jute waste, hemp, wastepaper, etc. are the common raw materials used for their manufacture. As has been stressed before, India abounds in cellulose bearing raw materials and the Panel therefore anticipates no difficulty regarding the availability of raw materials for the board industry.

Power requirements :—

82. Both power and steam are required for board manufacture. It is estimated that on an average ¾ to 1 ton of coal is required for 1 ton of straw-board and 2 to 3 tons of coal for 1 ton of other board. The straw-board industry will require 37,500 tons of coal in 1951 and 60,000 tons in 1956. Similarly the other board industry will require 62,000 tons in 1951 and 97,500 tons in 1956. With the advent of cheap hydroelectric power these quantitites will be considerably less.

Future expansion of the industry :—

83. Following the same arguments as have been advocated for the paper industry (paragraphs 43 and 44) the Panel recommends the following consumption and production targets for the Indian board industry :—

Type of product.	Anticipated annual consumption in 1951 (tons).	Anticipated annual consumption in 1956 (tons).
1. Straw-board	50,000	80,000
2. Duplex, Triplex and other types of boards	20,000	30,000
3. Insulating and pressed boards ..	3,000	5,000
4. Moulded products of boards	1,000	2,000
5. Jointing boards	1,000	2,000
Total boards ..	75,000	1,19,000

	Present annual effective production capacity	Anticipated indigenous production in		Imports in	
		1951	1956	1951	1956
	(tons).		(tons).		
Straw-board ..	24,000	50,000	80,000	*Nil.*	*Nil.*
Other boards ..	18,000	25,000	39,000	*Nil.*	*Nil.*

Location of new factories :—

84. Regarding location of new board mills the Panel makes the following recommendations :—

(*a*) *Straw-board* :—

One mill each in the following Provinces and States :—

1. Bombay.
2. Bengal near (Calcutta).
3. Orissa.
4. Sind.
5. Punjab.
6. Central Provinces and Berar.
7. Madras.
8. Hyderabad State.

(*b*) *Other boards* :—

One mill each in the following Provinces :—

1. Bombay.
2. United Provinces.
3. Bihar.

85. The Panel recommends that (1) the production of corrugated boards should be started as an adjunct to existing board mills (2) insulating and pressed boards should be produced in conjunction with sugar mills in the United Provinces and Bihar (3) the production of moulded products from pulp such as paper cups, dishes etc., should be started near large cities like Calcutta, Bombay, Madras and Delhi.

86. The Panel considers that a factory producing 6,000 tons of ordinary types of boards such as straw-board duplex, triplex, etc. per year is an economic unit under Indian conditions. Existing factories below this capacity should be encouraged to expand their production to this figure.

Prospects of establishing export trade:—

87. The Panel is of the opinion that there are extremely bright prospects of creating an export trade in straw-board during the post-war period. The abundance and cheapness of raw materials and labour add weight to this argument. It may be possible to export straw-board profitably to the neighbouring countries like Afghanistan, Egypt, Ceylon, Burma, Persia, etc., and compete favourably with foreign products. In this connection, the question of locating a few factories near the ports should be kept in view.

PART II.

Chemical Cotton.

88. Chemical cotton means cotton pulp. Cotton is the richest source of cellulose in nature. The cellulose content in chemical cotton is about 98%. Chemical cotton is generally used in processes where a higher percentage of cellulose is required. Staple cotton which is used in textile manufacture is a costly material to be used for cotton pulp. In view of the fact that cellulose finds use in such a large number of essential industries, cheaper sources of cellulose pulp were developed. Wood pulp has been utilised to a large extent, but on account of the low grade of cellulose obtained from this base and its unsuitability for various processes, cheaper sources of cotton have been tapped.

Cotton linters:—

89. Cotton linters, which are the short fibres left on the seed after the long cotton fibres have been removed by the ginning process, have been found to be good sources for the production of cheap chemical cotton. Though short in length, they are as pure as long cotton fibres so far as their cellulosic content is concerned.

Development of cotton linter industry in the U.S.A.:—

90. America is the largest producer of cotton linters. The first use for cotton linters in the U.S.A. was as stuffing material for matresses, cushions and upholstery. The development of the nitro-cellulose industry made the American chemist interested in cotton linters for use as the cellulose base. Need for tremendous quantitites of smokeless powder for World War I accelerated the use of cotton linters in the chemical industry. When the United States entered the war, orders were issued governing the cutting of cotton linters and the entire quantity was requisitioned for war purposes. Cotton linter production rose from approximately 0.4 million bales (1 bale is 500 lbs.) in 1910 to 1.3 million bales in 1916 and continued at a million bale level until after cessation of hostilities, when the market for nitro-cellulose explosives collapsed. Enormous quantitites of linters of varying quality and little peacetime value were then available. The production of cotton linters in the U.S.A. in the different years was as under :

(In million bales 1 bale—500 lbs.)

	1910	1916	1920	1930	1940
Total cotton (lint fibre) ..	12.0	11.5	13.0	14.0	12.0
Total raw cotton linters ..	0.4	1.3	0.44	1.0	1.5
Raw cotton linters used for chemical industries ..	..	..	..	0.5	0.8

91. After World War I new industries using cellulose bases, such as plastics, rayon, lacquers, commercial explosives advanced rapidly. Because of their high purity and low cost, purified cotton linters were soon

used in increasing quantities in these industries. From 1937 onwards the chemical industry consumed more than 50% of the cotton linter production in the United States of America.

Grades of cotton linters:—

92. Cotton linters are removed from the cotton seed by delinting machines and saw gins. There are usually three grades of cotton linters, (1) first cuts (2) second cuts (3) mill runs. First cuts range from 20 to 75 lbs. per ton of the seed and because of their long staple strength are used in the manufacture of surgical dressings, gauze bandages, absorbent cotton, mattresses, ropes etc. Second cuts range from about 100 lbs. to 200 lbs. per ton of seed. The lower grades of mill cuts are used as stuffing materisls for mattresses and for chemical cotton.

A fourth type of cotton linters made its appearance due to the active demand of cheap cellulose for chemical industries. There is a small amount of fuzz attached to the seed coat or hull when the seeds are decorticated and the kernels and hulls are separated. This fibre known as the hull fibre is removed by special machines and utilised for chemical manufacture.

93. The need for standardising cotton linters was keenly felt in the U.S.A. because of the varied and growing uses of cotton linters. The U.S.A. Department of Agriculture undertook this work and in 1924 fixed seven tentative grades of linters based chiefly on the different blends of the long and the short fibres contained in the linters. These grades were later accepted by the Inter State Cotton Seed Crushers Association and up to this day only graded linters are sold in American markets.

Possibilities of manufacturing chemical cotton in India:—

94. India is one of the major cotton growing countries of the world. The total amount of raw cotton produced in the country in 1943-44 was 5,072 thousand bales of 400 lbs. each. Besides short staple cotton, which is mainly grown in India, we are importing substantial quantities of long staple cotton from Egypt and America for superior varieties of textiles. Our short staple cotton which is considered unsuitable by our textile manufacturers is purchased at amazingly cheap prices by England, Japan and other industrially advanced countries. Besides short staple cotton, large quantities of cotton waste are also exported. These countries convert this cheap cotton into chemical cotton and manufacture varied types of materials which are sold to us in the form of consumer goods. Total exports of raw cotton and cotton waste in 1941-42 amounted to 0.25 and 0.04 million tons respectively.

95. The production of linters was practically unknown in this country uptil 1936. The production of ungraded linters developed to a certain extent in the subsequent years. A few ginning factories and cotton seed oil companies including Messrs. Govindram Seksaria Oil Mills, Hyderabad, Messrs. Volkart United Press Co., Mirpurkhas, Messrs. B.C.C.A. (Punjab) Ltd., Khanewal, and Birla Cotton Factory, Okara, have installed saw gins and are producing ungraded cotton linters.

It is believed that a few years back several thousand bales of cotton linters were lying at Karachi port for want of buyers. This lack of demand can possibly be attributed to their being ungraded. To create a demand for this material for the chemical industries and to produce supplies suitable for their requirements, it is necessary that steps should be taken to encourage the production of linters and to standardise the Indian linters in different grades on the same lines as has been done in America. There is a potential demand for cotton linters and chemical cotton in the world. It is possible that if the manufacture of chemical cotton is started in India, we may be able to capture an export market for it. Besides export, establishment of different industries such as rayon, plastics, explosives, raw films, lacquers etc. is being planned. It is therefore only natural that we should start the manufacture of chemical cotton which is a raw material for so many important industries in India in the post-war period.

96. The actual production of linters before the war was estimated at about 15,000 bales of 400 lbs. each. This production was however far short of the potential supply as large quantitites of cotton seeds were not delinted. It is difficult to make an accurate estimate of the total potential production of linters in India, but it is estimated, even if a fairly large proportion of the linter bearing seeds of the Indian varieties were delinted, about 75,000 bales of linters representing about 30 million lbs. will be available annually. The Panel very strongly recommends that early steps should be taken to make a survey of the potential supply of Indian linters and every assistance should be given by the Government, for the installation of delinting plants at the oil mills and other centres for extracting linters from seeds before they are either pressed for oil or exported out of India. In this way only a valuable raw material will be available for the development of several important industries such as explosives, rayon, plastics, lacquers etc., in India in which linters are used as the basis material, but also the cultivators of cotton will able to get a little higher price for their seeds.

97. The Panel recommends that five million lbs. of chemical cotton should be manufactured in the country per year during the next five year period. The fact that chemical cotton is only a raw material for other industries should however not be ignored. The establishment of the latter should therefore precede the establishment of chemical cotton manufacture in India.

SUMMARY OF RECOMMENDATIONS.

The Panel recommends the following consumption and production targets for the paper and board industries for the next five and ten year periods :—

Type of product.	Anticipated annual consumption in		Anticipated annual indigenous production in	
	1951	1956	1951	1956
	(tons).		(tons).	
1. All types of paper including newsprint ..	2,80,000	4,22,000	1,89,000	3,52,000
2. All types of boards including straw-board ..	75,000	1,19,000	75,000	1,19,000

2. The Panel recommends that the Government should arrange for the carrying out of an immediate and comprehensive survey of all cellulosic raw materials including soft and hard woods, bamboo, grass, other reeds, cotton linters, cotton wastes, etc., available in the country. The survey should be carried out through the Agriculture Department, Government of India.

3. Regarding location of new units for different types of paper and boards the Panel makes the following recommendations :—

(*a*) *Writing and printing paper including cheap quality writing and printing paper as mentioned in paragraph* 46 *of the report.*

One economic unit each with annual production capacity of 8,000 tons for the following Provinces and States :—

1. Madras. 2. Bombay. 3. Assam.
4. Punjab. 5. United Provinces. 6. Central Provinces and Berar.
7. Bihar. 8. Central India States. 9. Rewa State.
10. Eastern States Agency or Orissa.

(*b*) *Cheap wrapping paper* :—

6 units each of 5,000 tons annual production capacity producing light weight cheap wrapping paper and 2 units each of 10,000 tons annual production capacity producing heavy weight cheap wrapping paper.

One unit each for the following Provinces and States :—

1. United Provinces. 2. Bihar. 3. Bengal.
4. Bombay. 5. Madras. 6. Sind.
7. Punjab. 8. Central Provinces and Berar.

(*c*) *Kraft paper* :—

One unit each of 10,000 tons annual production capacity for the following Provinces and States :—

1. Bombay. 2. Central Provinces and Berar. 3. Orissa.

(*d*) *Newsprint*:—

An economic unit is one producing 20,000 tons of newsprint per annum. Newsprint mills can with advantage be located in the following Provinces and States:—

1. Hyderabad State. 2. Punjab or Kashmir State.
3. United Provinces or Tehri Garhwal State.

(*e*) *Straw-board*:—

One mill each in the following Provinces and States:—

1. Bombay. 2. Bengal (near Calcutta)
3. Orissa. 4. Sind.
5. Punjab. 6. Central Provinces and Berar.
7. Madras. 8. Hyderabad State.

(*f*) *Other boards*:—

One mill each in the following Provinces:—

1. Bombay. 2. United Provinces. 3. Bihar.

4. The Panel considers that a minimum economic unit under Indian conditions, for producing ordinary classes of paper is one producing 8,000 tons of paper per annum and for producing ordinary types of boards such as straw-board, duplex, triplex, etc. 6,000 tons per annum. Existing mills below these capacities should be encouraged to expand their production to the above figures.

5. In view of the fact that Bengal produces more than 50 per cent. of the total paper produced in the country, the Panel is of the opinion that new paper mills and the expansion of production by the existing mills for the production of same varieties of paper as are being produced there now should be discouraged.

6. Calculating on the basis of prevailing quotations for machinery, the Panel is of the opinion that capital goods worth about Rs. 10 crores will be required by the Indian paper and board industries during the next five year period.

7. The Panel recommends that the prospects of manufacturing paper pulp and board machinery and other essential stores and spare parts such as felts, machine wires, carbon rods, etc. in India should be thoroughly explored.

8. The Panel recommends that the present protection afforded to the paper industry should be continued, and the scope of protection should be extended so as to include varieties of paper and boards that remain unprotected at present. The degree and form of protection for different classes of paper and boards should be reviewed by the Tariff Board at an early date.

9. The Panel feels that the Indian paper and pulp industry can with advantage manufacture bamboo pulp for the rayon industry. Considerable research work has however to be carried out to standardise the specifications of bamboo pulp which will be suitable for rayon manufacture

10. The Panel feels that the production of hand-made paper should be expanded by organising the industry on systematic lines for the manufacture of special types of paper *e.g.* filter paper, bank paper, document paper, etc. The Provincial Governments should organise special centres for training and purchase a portion of their requirements of paper from this industry. Semi-mechanisation of some of the processes is also essential.

11. It is strongly felt that India should not remain dependent upon foreign supplies for newsprint which is a vital commodity of national importance. The Panel is therefore of the opinion that the establishment of newsprint manufacture in India during the post-war period is essential. In case private capital is not forthcoming to start this industry, the Government should themselves take up newsprint manufacture in the immediate post-war period.

12. The Panel strongly recommends that the Paper Pulp Section of the Forest Research Institute, Dehra Dun should be reorganised and enlarged into a Pulp and Paper Research Centre, for carrying out fundamental and technical research connected with pulp, paper and board industries. A sum of Rs. 20 lakhs should be allocated by the Government towards the capital cost of the proposed Centre.

13. The Panel recommends that six young Indians should be sent abroad every year by the Government for higher training in the pulp, paper and board technology.

14. In order to foster the growth and development of the Indian paper and board industries a statutory committee on the same lines as the Indian Central Cotton Committee should be constituted.

15. The Panel feels that there are bright prospects of creating an export trade in straw-board during the post-war period.

16. The Panel recommends that five million lbs. of chemical cotton should be manufactured in the country per year during the next five year period. The fact that chemical cotton is only a raw material for various industries such as explosives, rayon, plastics, lacquers, etc. should however not be ignored. The establishment of the latter should therefore precede the establishment of chemical cotton manufacture in India

M. L. Narasimiengar	.. ..	*Chairman.*
G. P. Birla	.. ..	*Members.*
M. P. Bhargava	.. ..	
E. Schoenberg	.. ..	
Jagraj*	.. ..	
K. Nizamuddin	.. ..	
C. D. Thakkar	.. ..	
A. S. Bhatnagar	.. ..	*Secretary.*

* Subject to Mr. Jagraj's separate minute of dissent on the subject of Protection covered by paragraph 61 of the report.

MINUTE OF DISSENT TO THE REPORT OF THE PAPER PANEL, 1946.

By

Mr. Jagraj.

I disagree with the necessity of continuing protection to the Paper Industry as protection has already been given for the long period of 20 years now.

India possesses vast raw materials and when the members met the representatives of the Provinces and the States, they were told that every Province and State has the necessary raw material and desired that the Panel should allocate the erection of 1 or more mills in their respective territories and when during discussion some of them were informed that no allocation for erection of mill has been made in any Province or state, their representatives felt very disappointed and pleaded for a change in the recommendation.

In some cases there was vagueness about the idea of the availability of suitable raw materials or the idea what quantity constituted an abundant supply of raw material but we all know :—

(*a*) that vegetable fibres are a perennial source of raw material for the paper and pulp industry.

(*b*) that vegetation flourishes where there is plenty of moisture and where there is plenty of heat.

In India there are large areas with plentiful rainfall and enough heat to help the growth of vegetation and where in such areas at present proper paper or board making quality of either grasses or woods is not grown, they can be grown by planned plantation. It should not be understood that at present there is any paucity of raw material only because quantitative or qualitative surveys have not been made. The members of the Panel generally were in agreement that raw material was abundant except for certain qualities of kraft and news print paper where there was some divergence in views.

There is no dearth of raw materials other than fibres, like coal, chemicals, fillers or power and with such a position coupled with the existance of a large home market there should be no justification for continuing the 20 year-old protection.

If Industry is left on its own after 20 years of protection, it will soon exert itself to get into efficient production and if an industry cannot live without protection after 20 years, it is not fit to live.

In the report of the Indian Industrial Commission it was advocated :—

(1) Nurse the baby;

(2) Protect the child; and

(3) Free the adult.

After 20 years the Paper Industry cannot be said to be either a baby or a child. It is now fully grown adult and if it cannot survive unprotected even now, it is certainly an unhealthy adult and not fit to survive.

India will have strong and healthy industries only if industries have to fight the battle of life and spoon-fed babies cannot grow to full stature. Kindly look to the allied line of straw-board manufacture. It had a healthy growth without protection and if the courageous step of discontinuing protection is now taken for the paper manufacture, that industry will also have a large healthy growth.

While on the subject of ability of industry to withstand the foreign competition it must be borne in mind that there is :—

(*a*) Revenue import duty.

(*b*) Ocean freight.

(*c*) Railway freight on interior markets,

and these three factors act as a measure of protection large enough and counteract any additional cost to Indian mills either on account of less efficiency of our operators or the smallness of our individual units. I therefore advise that the protection to the Indian Paper Industry be withdrawn early.

(Sd.) JAGRAJ.

Lahore,
Dated 20th November, 1946.

APPENDIX I.

Import Tariff Schedule.

(Paper and Paper Products).

As on 31st March, 1942.

Item No.	Name of the Article.	Nature of Duty.	Standard rate of Duty.	Preferential rate of duty if the article is the produce of manufacture of:	
				A British Colony.	Burma.
1	2	3	4	5	6
1	Wood pulp	Protective.	25% *ad valorem* or Rs. 30 per ton which ever is higher.	..	10% *ad valorem*
2	*Writing Paper* :— (*a*) Ruled or printed forms (including paper with printed headings) and envelopes made of writing paper and account and manuscript books and binding thereof.	Protective.	Nine pies per lb. or 25% *ad valorem* whichever is higher.	..	
3	(*b*) All other sorts	Protective.	Nine pies per lb. ..	..	
	Printing paper (excluding poster and stereo), and all coated papers, but including art paper, all sorts which contain no mechanical wood pulp or in which the mechanical wood pulp amount to less than 70% of the fibre contents.	Protective.	Nine pies per lb. ..	..	10% *ad valorem*
4	Printing paper, all sorts not otherwise specified which contain mechanical wood pulp amounting to not less than 70% of the fibre content.	Revenue.	25% *ad valorem* ..	..	10% *ad valorem*

	Paper including poster and stereo and all coated papers except art paper, all sorts, not otherwise specified.	Revenue.	25% *ad valorem*	..	..	10% *ad valorem*
6	Pasteboard, mill board, cardboard and strawboard all sorts.	,,	25% *ad valorem*	..	..	,,
7	Trade catalogues and advertising circulars imported by packet book or parcel post.	..	Free	..	..	10% *ad valorem*
8	Paper money	..	Free	..	..	
9	Newspapers, old, in bales and bags	Revenue.	25% *ad valorem*	..	..	10% *ad valorem*
10	Article made of paper and papier-maché stationery including drawing and copy books, labels, advertising circulars, sheet or card almanacs and calendars, Christmas, Easter and other cards including cards in booklet forms including also wastepaper but excluding paper and stationery otherwise specified.	Revenue.	,,	..	..	10% *ad valorem*
11	Books, printed, including covers for printed books, maps, charts, and plans, proofs, music, manuscripts, and illustrations specially made for binding in books.	Free.	Free	..	..	
12	Prints, engravings, and pictures (including Photographs and picture postcards) on paper or cardboard.	Revenue.	50% *ad valorem*	..	..	20% *ad valorem*

APPENDIX II.

Analysis of Paper and Board Production.

Period 1st April, 1944 to 31st December, 1945.

Mill.	Printings and Writings.	Kraft and Imit-Kraft	Wrappings Browns etc.	Duplex and Triplex.	Boards pulp Boards.	Other varieties.	Special @ varieties.	Total Production
Titaghur ..	18,627.2	262.6	1,476.7	..	2,180.7	785.6	1,102.7	24,435.5
Bengal ..	7,840	..	892.75	..	4.75	..	130	8,876.5
I.P.P. ..	6,140.8	..	34.35	..	108.5	7.5	23.2	6,314.35
Shreegopal ..	6,112.55	..	330.5	..	..	..	59.95	6,503.00
U.I.G. ..	1,143.87	.61	57.34	..	..	1,233.48	45.27	2,480.57
Star ..	2,753.29	..	42.42	..	..	..	..	2,795.71
Deccan ..	1,464.06	7.67	444.25	..	..	17.73	125.68	2,059.39
Gujarat ..	439.90	..	19.65	..	..	..	386.73	846.28
Andhra ..	1,220.02	..	39.1	..	..	..	..	1,259.12
Pudumjee* ..	46.38	..	107.0	..	..	..	..	153.38
Sirpur ..	2,929.61	113.1	323.35	..	..	23.93	10.73	3,400.72
Mysore ..	1,594.34	..	..	..	..	..	..	1,594.34
Punalur ..	1,628.58	9.4	990.41	..	..	..	53.	2,681.39
Rohtas ..	..	..	..	4,303.94	..	3,029.62	..	7,333.56
Orient ..	46.1	6,798.53	..	804.45	..	735.58	..	8,384.66
Totals ..	..	7,191.91	4,757.82	5,108.39	2,293.95	5,833.44	..	..
Totals ..	51,986.7	..	11,949.73	..	13,235.78	..	1,937.26	79,109.47

*These include—Ferro Basw, Match Paper, Teleprinter, Toilet, Target, Blotting, Cigarette Tissue, Emery Base Paper, on the basis the breakdown of an estimate production of 105,000 tons as follows :—

Production 105,000 ..	68,975	9,550	6,325	6,775	3,050	7,750	2,575	1,05,000
Total ...	68,975	15,875	..	17,575	..	..	2,675	..

@Production is for November and December only as for the period April to October inclusive this mill was incorporated with Deccan.

APPENDIX III (*a*).

Paper Production.

In 1944 and average annual potential production capacity of different mills.

1. *Paper* :

Mill.	Tons.	Average annual production capacity (Tons.)
Titaghur	31,012.9	31,000
Bengal	11,960.6	11,000
I.P.P.	8,403.2	8,000
Shree Gopal	8,548.5	8,000
U.I.C.	1,970	3,000
Star	3,4933.	3,600
Deccan	2,850	3,000
Gujerat	1,254	1,200
Andhra	1,556.3	2,500
*Pudumjee	153.4	..
Total ..	71,301.2	

*This mill was owned by Deccan Paper Mills but was sold on 23rd October, 1944 and is now operated as a separate concern. Production for the period January-October inclusive is included under Deccan.

State Mills :

Sirpur	4,471.4	5,000
Mysore	2,470.4	4,000
Punalur	3,524.9	3,500
Total ..	10,466.7	
Total (Paper) ..	81,767.9	

2. *Kraft.*

Orient	8,859.4	10,000

3. *Boards.*

Rohtas	9,772.3	
U.I.C.	1,359.4	
Orient	2,124.2	
Total ..	13,255	

4. Total Paper Kraft, Boards .. 13,883.2

APPENDIX II(*b*).

Actuals.

Paper Production, 1943.

Mills.	Tons.
Titaghur	32,177.8
Bengal	11,560.35
I.P.P.	8,451
Shree Gopal ..	7,540.86
U.I.C.	4,264.33
Star	3,901
Deccan	3,127.67
Gujarat	1,212.78
Andhra	1,275.38
Orient	9,544.47
Rohtas	8,818.54
State Mills.	
Sirpur	4,806.12
Mysore	3,049.24
Punalur	2,462.7
Total paper, kraft, boards ..	102,192.14

APPENDIX II(c).

Actuals.

Paper Production.

Period 1st January, 1944 to 30th June, 1944.

1, *Paper*

Mill.	Tons.
Titaghur	13,633.2
Bengal	5,990.4
I.P.P.	4,092
Shree Gopal	4,246.9
U.I.C.	1,180.5
Star	1,518.9
Deccan	1,471
Gujarat	704.7
Andhra	587
Total ..	33,424.6

State Mills.

Sirpur	2,198.3
Mysore	947.6
Punalur	1,666.7
Total ..	4,812.6
Total Paper ..	38,237.2

2. *Kraft.*

Orient	3,977.7

3. *Boards.*

Rohtas	4,757.7
U.I.C.	433.9
Orient	1,087.6
Total ..	6,279.2

APPENDIX II (*d*).

Production of paper in India in pre-war years.

The Years are from April to March.

Quality.	1936-37 Tons.	1937-38 Tons.	1938-39 Tons.	Average Tons.	1941-42 Tons.
Printing Paper ..	28,744	31,412	31,642	30,599	47,400
Writing Paper..	14,620	16,386	20,291	17,099	16,223
Packing & Wrapping paper ..	2,956	3,521	3,647	3,375	18,238
Boards of all kinds	82	212	353	216	6,306
Other varieties of Paper ..	2,129	2,280	3,264	2,559	5,380
Totals ..	48,531	53,811	59,197	53,848	93,547

APPENDIX II(*e*).

Production of Paper in India during war years.

The years are April to March.

Quality.	1939-40 Tons.	1940-41 Tons.	1941-42 Tons.	1942-43 Tons.
Printing	39,832	44,513	47,400	55,099
Writing	19,742	21,096	16,223	9,751
Packing and Wrapping Paper	5,213	12,772	18,238	16,984
Boards of all kinds and other varieties of paper ..	6,026	9,281	11,686	9,207
Total ..	70,813	87,662	93,547	91,041

Sources :—*Pre-war.*

"Monthly Statistics of Certain Selected Industries". Published by Director General of Commercial Intelligence and Statistics.

War Years.

Indian Paper Mills Association, believed to have been taken from Director General of Commercial Intelligence and Statistics.

APPENDIX II(f).

Annual Production in Tons of Writing, Printing and Wrapping Papers and Boards.

1924-25	..	27,020	1925-26	..	28,221
1926-27	..	31,672	1927-28	..	34,678
1928-29	..	38,222	1929-30	..	38,609
1930-31		39,587	1931-32	..	40,558
1932-33	..	40,217	1933-34	..	43,658
1934-35	..	44,601	1935-36	..	48,099
1936-37	..	48,531	1937-38	..	53,811
1938-39	..	59,198	1939-40	..	70,813
1940-41	..	87,662	1941-42	..	93,547
1942-43	..	100,282*	1943-44	..	99,831*
			1944-45	..	70,020*

(For 8 months upto November, 1944).

*Approximate figures.

APPENDIX III.

Total Quantities of Chemicals required.

	Name of Chemical.	1951 Tons.	1956 Tons.
1.	Caustic Soda	10,600	18,400
2.	Salt Cake	43,000	73,000
3.	Sulphur	5,200	8,800
4.	Magnesite	3,700	6,300
5.	Lime	92,000	1,60,000
6.	Soda Ash	16,000	30,000
7.	Clorine	7,000	11,000
8.	Ferric Alum	12,600	22,600
9.	Aluminium Sulphate ..	1,000	1,800
10.	Rosin	5,800	10,800
11.	Clay	30,000	47,300
12.	Miscellaneous :—		
	Dyes		
	French chalk		
	Barytes		
	Starch		
	Silicate	3,100	5,400
	Glue		
	Wax		
	Sulphuric Acid ..		
	Hydrocloric Acid ..		
	Total ..	2,30,000	3,94,000

APPENDIX IV.

Centrewise Requirements of Raw Materials for 1944.

(In Tons.)

Names of the Ra Materials.	Bengal.	Bihar.	U.P.	Punjab.	Bombay.	S. India	Total.
1. Coal	1,81,316	79,6 2	28,790	37,463	6,000	12,718	3,45,979
2. Diesel Oil	..	..	..	..	600	..	600
3. Furnace Oil	..	..	..	350	..	..	350
4. Grass	29,786	..	18,300	17,000	..	..	60,086
5. Bamboo	1,04,000	57,000	..	..	..	*26,000	1,87,000
6. Reeds	..	..	..	..	*..	6,000	6,000
7. Wastepaper	6,600	4,000	600	1,000	..	5,200	17,400
8. Hemp	1,100	6,000	..	..	123	150	7,373
9. Rags, Cloth Cuttings, Tailor's Cuttings	1,200	8,000	..	4,320	4,880	1,550	19,950
10. Soda Ash	325	3,400	1,200	..	24	1,410	6,359
11. Caustic Soda	3,438	2,280	1,100	700	75	1,480	9,073
12. Bleaching Powder ..	646	..	..	..	134	730	1,500
13. Alum Ferric	3,686	2,100	400	900	380	910	8,376
14. Liquid Chlorine ..	950	..	250	..	..	..	1,200
15. Rosin	1,161	450	60	192	135	475	2,473
16. Salt	8,286	2,712	..	900	36	2,750	14,684
17. Sulphur	2,600	924	..	..	..	..	3,524
18. Lime	22,600	10,800	3,000	..	240	500	37,140
19. China Clay	11,140	1,973	700	900	160	..	14,873
20. French Chalk	..	..	..	600	..	..	600
21. Alkali	773	..	..	..	..	..	773

*One of the mills in S. India intimated their requirements of Bamboo in numbers, *i.e.* 15 lacs, and not in tons.

APPENDIX IV.—(*Concluded.*)

Names of the Raw Materials.	Bengal.	Behar.	U. P.	Punjab.	Bombay.	S. India.	Total
22. Casein	26	..	..	..	4	12	42
23. Sulphuric Acid ..	15	1,200	..	..	..	..	1,215
24. Magnesite	1,800	..	..	..	..	..	1,800
25. Lime Stone	..	8,400	..	3,000	..	4,000	15,400
26. Barium Chloride ..	..	60	..	..	..	..	72
27. Soda Sulphate ..	..	1,500	..	..	..	140	1,640
28. Starch	..	65	..	..	..	..	65
29. Sodi Silicate	..	54	..	..	..	..	54
30. Bauxite	..	840	..	..	..	..	840

APRENDIX IV (*a*).

Approximate Annual Requirements of the Principal Raw Materials in Tons for Maximum Output.

Names of the Paper Mills.	Bamboo.	Sabai grass.	Rags.
1. Titaghur	68,000	14,000	800
2. Bengal	18,000	15,000	1,200
3. India Paper Pulp ..	18,000	..	500
4. Orient	36,000	..	2,000
5. Rohtas	30,000	..	6,000
6. Sirpur	18,000	..	..
7. Upper India Couper ..	..	7,000	3,000
8. Star	..	13,000	..
9. Shree Gopal ..	..	17,000	4,000
10. Deccan	..	..	2,400
11. Andhra	6,000	..	..
12. Punalur	8,000	..	400
13. Mysore	8,000	..	1,200
14. Gujrat	..	..	..
Total ..	2,10,000	66,000	21,500

APPENDIX IV(*b*).

Average Monthly Requirements of Different Chemicals in Tons.

Name of the Paper Mills.	Alum Ferric.	Caustic Soda.	Soda Ash.	Salt Cake and Salt.	Sodium Sulphide	Bleaching Powder.	Sulphur.	Magnesite.	Rosin.	China Clay.	Barium Chloride
1. Titaghur	210*	25*	103	160	60	25*	..	..	46	290	..
2. Bengal	90	70	..	90	..	125	..	..	17	125	..
3. Indian Paper Pulp	40*	...	..	..	..	130	120	92	18	75	..
4. Shree Gopal	70	60	3	90	..	35	..	..	12	70	..
5. Star ..	36	10*	60	..	..	75	..	..	8	40	..
6. Upper India Paper	35	3	20	..	..	10*	..	..	8	40	..
7. Sirpur..	40	25*	40	60	..	..	..	..	11	45	1
8. Mysore	25	45*	50	40	10	..	..	..	6	35	..
9. Deccan	10	1*	1	..	..	1*	..	..	6	30	..
10. Punalur	10	30	40	..	6	..	..	..	3	30	..
11. Gujrat	12	13	..	..	..	10	..	..	3	20	..
12. Andhra	12	58	..	10	5	25	..	..	6	25	..
13. Orient	110	25	200	..	10	..	..	..	20	..	..
14. Rohtas	40	120	100	150	...	..	..	..	15	..	3
Total ..	740	485	617	600	91	436	120	92	179	815	4

*In addition to the quantities manufactured by these Mills.

APPENDIX IV(*c*).

Analysis of Coal Requirements of the Paper Industry.

(In Tons.)

Based on the period 1st January, 1944 to 31st December, 1944.

1. *Principal Paper and Board Mills.*

Mill.	Total coal Allocation.	Total Coal Consumption.	Total Paper and Board Production	Coal required per ton. of paper.	Potential production per month.	Coal* required for potential production.
Titaghur ..	1,28,200	1,13,446	30,908.3	3.67	3,000	11,020
Bengal ..	37,540	48,194	11,960.6	4.02	1,100	4,420
I.P.P. ..	30,200	30,486	8,493.2	3.58	750	2,680
Shree Gopal ..	30,920	32,099.1	8,548.5	3.75	300	3,000
Star ..	18,560	15,466	3,493.3	4.42	500	2,220
U.I.C. ..	15,600	13,530	3,348.4	4.04	425	1,720
Mysore ..	9,900	4,965	2,424.4	2.04	325	660
Deccan ..	5,100	4,865.6	2,850.0	1.70	275	480
Gujarat ..	2,486	2,345	1,254.0	1.87	150	280
Andhra ..	6,800	7,752.9	1,556.3	4.98	225	1,120
Orient ..	36,500	40,192.9	10,942.5	3.67	1,100	4,040
Kohtas ..	3,33,890	39,467.7	9,772.3	4.03	1,000	4,040
Totals ..	3,55,690	3,52,810.2	95,551.8	(**)	9,650	35,680

(**) Equals 115,800 tons per annum.

2. *Straw-board and Mill Board Mills.* (@)

Jaswant ..	3,550	2,278.2	1,415.1	0.69	500	360
Straw Products ..	7,670	6,540.9	1,569.7	1.78	500	900
Straw Mfg. ..	2,300	1,546.2	579.5	1.18	435	520
Standard ..	1,420	1,726.1	971.5	1.18	420	500
Totals ..	14,940	12,091.4	4,535.8	..	1,855	2,280
Grand Totals ..	370,630	364,901.6	..	..	..	37,960

(@) Production for the period August-December, 1944 only.
(*) To the nearest complete wagon *i.e.* 20 tons.

3. The following Mills are excluded from the above figures in (1) and (2) above.

(*a*) *Sirpur*:—This mill receives a separate allocation from the Coal Controller, Secunderabad, on the Singareni Mines amounting to approximately 3,000 tons per month. Considering the average production of this mill is 400 tons per month and after allowing for the poor quality of the Singareni coal, this allocation is considered to be high. The matter is being investigated.

(*b*) *Punalur*:—This mill uses fuel wood only.

(*c*) *Pudumji Mills*:—This mill has recently converted its boilers to oil firing.

(*d*) *Paper Processing*:—In addition to keeping the mills supplied, coal from the industry's allocation has been allocated to contractors processing paper, *i.e.* wazing, water-proofing, carton making, which contracts are issued by this Directorate. Such miscellaneous all contains amounted to 1,370 in 1944.

4.	Total allocated to the industry during 1944 ..	3,72,000 tons.
	Total received by the industry during 1944 ..	3,50,150.5 tons.
	Stock held by the mills on 1st January, 1944 ..	31,439.6 tons.
	Stock held by the mills on 31st December, 1944	13,607.3 tons.
5.	Total estimated monthly allocation which is required to meet the full needs of those mills who are at present receiving all allocation, to bring in those smaller mills who have been receiving no allocation upto now and to cover the requirements of contractors processing paper etc.	39,300 tons.
	This is the quantity actually required to be received by the quota holders which means that on the basis of the experience of the relationship between allocations and receipt during 1944, the quota required on paper to meet the above requirements would be :	41,600 tons.

APPENDIX IV (*d*).

Production of Caustic and Chlorine by Paper Mills.

Serial No.	Names of Paper Mills.	Cell in use.	Caustic Soda.		Chlorine.		Remarks
			Production during 1943.	Production during first 6 months of 1944.	Production during 1943.	Production during first 6 months of 1944.	
1	2	3	4	5	6	7	8
1	Titaghur Paper Mills	Nelson cells..	Tons. 2,422	Tons. 1,162	Tons. 2,123	Tons. 1,003	3-550 KVA Transformers connected to 3-550 KW Rotary converters—750 R.P.M. Input 136/164 volts A.C. Output 170-24 volts D.C. Cells:—300 Cells at 100 cells per machine connected in parallel banks of 50 cells in series.
2	Shree Gopal Paper Mills.	KML type Allen Moore.	475	253	387	207	One set for 40 cells 250 K.W. 980 R.P.M. 100/120 Volts 1200/1500 AMPS.
3	Deccan Paper Mills.	Mather Plates.	..	..	2.30	1.50	No, but have Belt driver D.C. Dynamo capable of producing 220 Volts and 100 AMPS driven by a separate A.C. Motor.

APPENDIX IV(d)—(*Contd.*)

1	2	3	4	5	6	7	8
4	Mysore Paper Mills.	Siemons Pestatozza.	..	..	63	5.50	One set Induction Motor—3 Phase 440 vy. 338 amps. 105 K.W. 735 R.P.M. F.P.C. 9.25 Cycles. Rot 435 vy. 280 amps. D.C. generator 94/110 volts 1500 lamps, 141/165 K.W. 735 R.P.M. Self Excitation 94/110 Volts.
5	Sirpur Paper Mills.	Allen Moore	292	140	254	120	Wasting House Generator Set 210 K.W.
6	Rohtas Industries Ltd.	20 Mercury Cells moving Cathode-Krehs system II Diaphragm Cells-horizontal diaphragm.	648.35	263.43	539.99	239.68	Two Motor generator sets ran parallel for the 20 mercury Cells :— (1) 90 Volts. 4000 amps. (now running at 1000 amps.) (2) 220 Volts 1300 amps. (Now running at 900 amps.) one Motor generator set for the diaphragm Cell : 100 Volts—2600 amps. (Now running at 1200 amps.) condition of these generators are not satisfactory and therefore not getting full lead according to specification.
		Total ..	3,837.35	1818.43	3423.20	1576.68	

APPENDIX V.

Imports of Paper making raw material and paper mill machinery in India.

(1935-36 *to* 1943-44).

Years.	Wood Pulp.		Bags and other materials.		Machinery
	'Q'	'V'	'Q'	'V'	'V'
1935-36 ..	15,471	20.4	1	734 (Rs.)	8.0
1936-37 ..	11,047	14.5	14	8,272 ,,	7.8
1937-38 ..	10,716	17.1	325	.11	44.8
1938-39 ..	13,845	25.8	493	.14	27.6
1939-40 ..	11,715	21.8	804	.17	13.3
1940-41 ..	4,443	12.2	524	.04	31.0
1941-42 ..	2,916	10.6	666	.05	31.0
1942-43 ..	623	2.5	197	.02	15.0
1943-44 ..	892	3.7	242	.05	25.1

'Q'—Quantity in tons.

'V'—Value in lakhs Rs.

APPENDIX V(*a*).

Imports of Printing and Writing Papers in India.

(1935-36 *to* 1943-44).

Years.	Printing Paper.		Writing Paper.		Litho and Poster Papers etc	
	'Q'	'V'	'Q'	'V'	'Q'	'V'
1935-36 ..	14,597	38.8	7,361	34.7	1,809	4.7
1936-37 ..	10,790	30.0	7,524	33.5	1,523	3.7
1937-38 ..	15,339	51.8	8,949	46.6	2,484	8.7
1938-39 ..	12,004	36.5	9,076	44.5	1,513	4.3
1939-40 ..	8,752	30.6	6,754	34.4	1,218	3.7
1940-41 ..	5,051	29.3	3,231	28.6	261	1.5
1941-42 ..	3,054	29.3	1,460	18.6	123	0.7
1942-43 ..	558	8.2	984	14.5	53	0.7
1943-44 ..	926	12.6	924	14.6	68	0.6

'Q'—Quantity in tons. 'V'—Value in lakhs rupees.

APPENDIX V(*b*).

Import of Newsprint in India.

(1935-36 *to* 1943-44).

Years.	Quantity (tons).	Value (lakhs Rs.)
1935-36	34,327	52.4
1936-37	36,748	52.9
1937-38	43,245	78.7
1938-39	32,540	51.8
1939-40	36,714	71.3
1940-41	30,730	89.1
1941-42	28,277	109.3
1942-43	11,237	57.6
1943-44	13,777	45.7

APPENDIX V(*c*).

Imports of baled Newspapers in India.

(1935-36 *to* 1943-44).

Years.	Quantity in Tons.	Value (in lakhs Rs.)
1935-36	57,583	41.6
1936-37	64,730	38.8
1937-38	48,809	47.4
1938-39	47,383	38.5
1939-40	33,357	38.3
1940-41	35,214	56.8
1941-42	12,507	29.8
1942-43	1,191	2.99
1943-44	5	.01

APPENDIX V(*d*).

Import of blotting papers, paper manufactures etc. in India.

Years.	Blotting paper.		Other sorts of Paper.		Paper Manufactures.	
	'Q'	'V'	'Q'	'V'	'Q'	'V'
1935-36 ..	302	1.6	3,543	19.7	2,018	15.5
1936-37 ..	277	1.5	3,528	19.3	2,049	17.7
1937-38 ..	285	1.7	2,938	20.6	2,399	20.3
1938-39 ..	250	1.3	2,875	18.0	1,537	16.1
1939-40 ..	212	1.6	1,921	13.7	1,600	13.2
1940-41 ..	116	1.0	1,156	17.5	1,156	19.4
1941-42 ..	104	1.1	1,163	28.2	1,760	22.5
1942-43 ..	32	0.4	1,509	42.1	731	13.7
1943-44 ..	15	0.2	1,340	36.4	113	3.1

'Q'—Quantity in tons. 'V' Value in Lakhs Rs.

APPENDIX

Imports of wrapping

(1935-36 *to*

Product.	1935-36.		1936-37.		1937-38.	
	Q	V	Q	V	Q	V
1. Kraft (Including imitation kraft). ..	9,543	21.4	8,626	19.9	13,804	39.0
2. Brown wrappings (other sorts) ..	678	1.2	323	0.5	381	0.9
3. Coloured machine-glazed pressings ..	532	1.0	476	0.8	160	0.3
4. Manilla, machine glazed or unglazed ..	1,851	4.1	1,881	4.1	2,527	7.2
5. Fancy including embossed ..	124	0.9	48	0.5	248	2.4
6. Oil waxed and other waterproof wrappings	..	..	..	..	..	..
7. Other sorts ..	7,543	24.2	6,851	21.2	8,396	34.0
Total ..	20,274	53.0	18,207	48.0	25,520	83.8

Q-Quantity in tons.
V-Value in Rs. (lakhs).

V(*e*).

papers in India.

1943-44).

1938-39.		1939-40.		1940-41.		1941-42.		1942-43.		1943-44.	
Q	V	Q	V		V	Q	V	Q	V	Q	V
8,430	24.2	10,150	40.0	3,419	20.0	2,337	13.4	440	3.4	1,004	7.0
527	1.1	270	0.6	161	0.8	78	0.4	16	0.1	..	..
241	0.5	170	0.3	22	0.1	10	0.05	..	..	..	..
2,173	5.8	1,437	4.8	383	2.1	265	1.8	..	..	..	..
128	1.3	50	0.6	24	0.8	11	0.2	4	.06	..	..
1,319	5.5	1,463	6.6	1,428	11.2	700	6.4	258	2.7	368	..
6,568	28.0	5,360	20.0	4,100	41.2	3,442	46.1	1,428	46.1	2,408	88.0
19,803	66.4	13,901	82.5	9,046	76.2	6,845	68.2	2,148	25.2	3,780	49.1

APPENDIX VI.

List of Paper Mills in India.

1. Titaghur Paper Mills, Chartered Bank buildings, Calcutta.
2. Factories—Titaghur and Kankinara 24, Parganas, Bengal.
3. Bengal Paper Mills Co. Ltd., 103, Clive Street, Calcutta. Factory—Raniganj Burdwan.
4. India Paper Pulp Co., Ltd., 8, Clive Street, Calcutta. Factory—Halisatar Naihati.
5. Shree Gopal Paper Mills Ltd., Jagadhri N.W.R.
6. Star Paper Mills Ltd., 117, Russa Road, Calcutta. Factory—Saharanpur.
7. Upper India Couper Paper Mills Co., Ltd., Lucknow.
8. Mysore Paper Mills Ltd., Bhadravati, Mysore State.
9. Deccan Paper Mills Co., Ltd., 815-16, Bhowani Peth, Poona.
10. Gujrat Paper Mills Ltd., 653, Sakar Bazaar, Ahmedabad.
11. Andhra Paper Mills, Co., Ltd., Rajamundry (Madras).
12. Sirpur Paper Mills Ltd., Sirpur, Kaghaznagar.
13. Punalur Paper Mills Ltd., Punalur, Travancore State.
14. Orient Paper Mills Ltd., 8, Royal Exchange Place, Calcutta. Factory—District Sambhalpur, Orissa.
15. Pudumjee Paper Mills, Lamington Road, Bombay.
16. Rohtas Industries Ltd., Dalmianagar, Bihar.

APPENDIX VII.

Imports of Straw boards, other boards, Board Manufactures in India.

(1930-31 *to* 1943-44).

Years.	Straw-boards.		Other boards.		Board manufactures.	
	'Q'	'V'	'Q'	'V'	'Q'	'V'
1930-31 ..	11,910	14.5	3,260	10.4	253	1.8
1931-32 ..	9,872	11.6	3,531	11.0	372	3.3
1932-33 ..	14,989	18.4	5,630	16.2	356	2.5
1933-34 ..	9,714	9.5	5,645	14.2	492	3.9
1934-35 ..	13,210	12.2	6,731	15.9	906	5.2
1935-36 ..	15,089	12.8	9,085	20 8	671	2.8
1936-37 ..	13,450	11.3	10,156	21.1	638	2.9
1937-38 ..	17,044	16.7	13,462	33.3	1,177	5.0
1938-39 ..	16,876	17.0	8,566	22.1	1,614	5.3
1939-40 ..	15,353	25.6	8,909	34.9	1,358	5 8
1940-41 ..	7,006	15.1	9,268	42.7	916	7.4
1941-42 ..	2,278	7.3	7,567	40 4	247	2.6
1942-43 ..	53	0.3	2,358	11.7	217	2.1
1943-44 ..	..	..	1,519	13.6	123	1.9

Q-Quantity in tons. V-Value in lakhs rupees.

APPENDIX VIII.

Annual Potential capacities of different Board Factories.

	Name of Mill.	(In tons.)
1.	Rohtas Industries Ltd., Dalmianagar	10,000
2.	Straw-Board Manufacturing Co. Ltd., Saharanpur ..	6,000
3.	Straw Products Ltd., Bhopal	6,000
4.	Jaswant Straw-board Mills Ltd., Meerut	6,000
5.	Upper India Couper Paper Mills Ltd., Lucknow ..	2,000
6.	Orient Paper Mills Ltd.	4,000
7.	Standard Board and Paper Mills Ltd., Calcutta ..	3,000
8.	Rewa Board Mills, Rewa	3,000
9.	Pioneer Paper and Pulp Mills Ltd., Calcutta	1,000
10.	India Paper and Board Mills Ltd., Dum Dum, Calcutta ..	1,000
11.	Other small Board Mills in Bengal	1,000
12.	Western India Paper and Board Mills Ltd., Bombay ..	1,000
13.	Arwin Paper and Board Mills, Billimora (Gujerat) ..	3,000
14.	Gujerat Paper Mills Ltd., Ahmedabad	900
	Total ..	47,900

Note :—The above list includes names of only those which are in actual production. The present production of many of these Mills is much below their potential capacitites. There are several other Mills under construction or ready for starting work. Besides, names of very small plants have not been mentioned.

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REPORT

OF THE

ELECTRICAL MACHINERY

AND

EQUIPMENT PANEL

ON THE

DEVELOPMENT OF ELECTRICAL INDUSTRIES

GOVERNMENT OF INDIA

DEPARTMENT OF INDUSTRIES & SUPPLIES

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PREFACE

(i) *Scope.*—The Electrical Machinery and Equipment Panel was constituted by the Planning and Development Department of the Government of India to make recommendations to the Government regarding the post-war development of both existing and new electrical machinery and equipment industries in India. The general directive issued to Industrial Panels (Appendix I) constitutes the terms of reference of the Panel.

(ii) *Membership.*—The Panel was constituted as far back as March 1945 but it was unable to commence its work as the Government could not appoint a Secretary till April 1946.

The Main Panel and Sub-Panel originally formed by the Government consisted of the following:

Main Panel.

Mr. (now Sir) Ghulam Mohammed.	(*Chairman*).
Mr. H. M. Mathews.	*Members*
Mr. Kishenchand.	(,,)
Mr. E. V. Small.	(,,)
Mr. R. D. Char.	(,,)
Mr. V. S. Risoe.	(,,)
Khan Bahadur A. G. Khan.	(,,)

Sub-Panel.

Mr. B. K. Rohatgi.	(*Chairman*).
Dr. M. T. Ahmad.	*Members*
Mr. K. C. Roy.	(,,)

Subsequently owing to the sad demise of Mr. K. C. Roy, the Sub-Panel was allowed to lapse and Mr. B. K. Rohatgi and Dr. M. T. Ahmad were nominated as members of the Main Panel. At the suggestion of the Panel, the following were co-opted as members of the Panel:—

Mr. A. J. Emery.
Prof. S. K. Roy.
Mr. H. Sur.
Mr. S. Bhalla.

Dr. M. T. Ahmad left for England on 21st June 1946, with the Technical Mission appointed by the Government of India and could not attend the Panel meetings. Mr. V. S. Risoe resigned his membership on 10th August 1946. At the first meeting of the Panel, Mr. H. M. Mathews gave a talk on the post-war development of electricity supply but thereafter owing to heavy pressure from Government on his time, he could not attend the subsequent meetings. He, however, deputed Mr. H. S. Kulkarni of his Office to be associated with the deliberations of the Panel on his behalf.

(iii) *Panel Meetings.*—The Panel met for the first time at Calcutta on 16th, 17th and 18th May 1946 and held its second meeting also at Calcutta on 26th and 27th June 1946. At the latter meeting representatives of the Indian Chamber of Commerce, Calcutta, and the Bengal Chamber of Commerce, Calcutta, were interviewed. The third meeting was held at Bombay on 12th, 13th and 14th August 1946, when representatives of the Indian Merchants' Chamber, Bombay, the Chamber of Commerce, Bombay,

All-India Manufacturers' Organisation and Director of Industries, Bombay, were interviewed. The fourth meeting was held at Bombay on 25th and 26th November 1946 and representatives of Provincial Governments and States were invited to attend the last meeting held on 22nd April 1947, at New Delhi.

At the second meeting, two Sub-Committees for Heavy Electrical and Light Electrical Industries were formed, to study and formulate preliminary recommendations in respect of these industries. The Sub-Committees consisted of the following members:—

Heavy Electrical Industries Sub-Committee	Light Electrical Industries Sub-Committee
Mr. Shivraj Bhalla (Chairman).	Mr. H. Sur (Chairman),
Khan Bahadur A. G. Khan.	Mr. Shivraj Bhalla.
Mr. E. V. Small.	Mr. A. J. Emery.
Mr. H.S. Kulkarni.	Mr. R. D. Char.
Mr. Kishenchand.	Mr. B. K. Rohatgi.
Mr. B. K. Rohatgi.	Mr. Kishenchand.
Mr. T. B. Merchant (Secretary)	Mr. T. B. Merchant (Secretary)

The list of items dealt with by the Sub-Committees is given in Appendix II.

The meetings of the Light Electrical and the Heavy Electrical Industries Sub-Committees were held on 23rd and 24th July 1946 and 25th and 26th July 1946 respectively in Calcutta.

(iv) *Plan of Work.*—The Panel visited the factories of Messers Associated Electrical Industries Manufacturing Co., Ltd., Calcutta and Messers. India Electric Works Ltd., Calcutta. The Secretary visited several other factories at Calcutta and Bombay.

For collecting relevant information questionnaires (Appendix III) were sent to 168 important industrial firms, 28 principal Chambers of Commerce and Trade Associations and 13 Provincial/Central Government Departments. Representatives of certain firms were also interviewed by the Panel.

I have to record with regret that, inspite of the greatest efforts, information made available by certain industrial firms and Government Departments, has been most unsatisfactory. Altogether over two hundred parties were approached for information but the response was extremely poor.

The Panel's work was considerably handicapped by the All-India Postal Strike and the disturbed conditions prevailing in the country.

(v) *Acknowledgements.*—I am grateful to the members of the Panel and the various organizations that co-operated in providing useful advice and information which have been of considerable assistance in the preparation of the Report.

Although every effort has been made to ensure the accuracy of information presented in this report it is to be noted that the Panel does not accept responsibility for any errors or omissions.

CHAIRMAN.

INTRODUCTION

1. The Government of India in a statement of Industrial Policy issued on April 1, 1945, have categorically stated that Government have decided to take positive steps to encourage and promote the rapid industrialization of the country to the fullest extent. The Government have laid down the fundamental objects of industrialization to be three-folds:—

"(i) To increase the national wealth by the maximum exploitation of the country's resources. It is well known that there are considerable unsued resources of man power and material, and clearly Government policy must be directed towards stimulating their fullest and most effective utilisation.

(ii) To make the country better prepared for defence. The experience of two Wars has demonstrated the dangers, both to India and to the rest of the Commonwealth inherent in India's independence on overseas supplies for vital commodities required for defence.

(iii) To provide a high and stable level of employment. At present the volume of industrial employment is comparatively speaking small but if the country's industrial resources are developed to their maximum possible extent, Industrial employment in ancillary trades and professions, will considerably affect the volume of total employment in the country. Government consider that their industrial policy should be directed towards maintaining employment at the highest possible degree of stability and volume."

2. In dealing with an industry like the one before us we cannot forget the fact that the products of the industry have a wide application in every field of life. The indirect benefits to the country at a stage when rapid all-round industrialization is the target, cannot be ignored.

3. We have kept in view the necessity of developing the industries on commercially sound lines. Where we have disgressed from that objective we had to bear in mind the needs of the industry as a whole. Nevertheless, we have in our recommendations not endeavoured an experiment of doubtful value.

4. **Benefits to the Country and Other Industries.**—The development of local manufacture of electrical machinery and equipment at an economical price is bound to rosult in extensive benefit to the country. For example, the increasing use of Refrigeration Plant will assist the development of fisheries, storage of agriculturist products particuularly, milk, medicines and such other products as are highly sensitive to climatic conditions prevailing in the country. With the proposed expansion of electrical energy it should be possible for the industry under investigation to provide numerous items of equipment to assist the expansion of cottage industries, which are very necessary to increase the purchasing power of an agricultural country like India.

5. It is well-known that the medical and educational facilities provided in the country in the shape of hospitals, nursing homes, schools, colleges, etc., are very inadequate for the needs of the country. It will be the responsibility of Indian industry to provide electrical equipment for institutions of this nature, which, with the schemes that Government have for improvement of such facilities, should give the electrical industry ample incentive for improved and efficient production.

6. The estimated consumption of radio sets and equipment is expected to be approximately ten times that of pre-war level. Such factors as heavy customs duty and middle-man's high profit have prevented the popularity of radio sets in this country. Yet the people have without doubt realised the value of keener interest in world events and with the aid of cheap and efficient locally manufactured radio sets, as recommended in this Report, it will be

possible to institute a country-wide drive against illiteracy and ignorance prevailing in the vast population of the country.

7. The labour costs in India are rapidly increasing and it is essential that proportionate increase in effic ency also is achieved to ensure taht the industries do not suffer owing to high labour costs. In America as labour costs increased, the industries adopted more and more extensively mass production methods which have now become a specialised feature in that country. Electrical machinery and equipment play an important role in the development of mass production method.

8. It will be seen from above that the industry under investigation is of extreme importance in very field of life. The Panel believe that adequate measures have been specified in the Report for economic and efficient manufacture, and whilst it is necessary for the industry to play its part, it is equally incumbent on Government to provide the assistance and facilities necessitated by the industrial backwardness of the country. For example, in any steps that Government take for improvement of purchasing power, education, agricultural conditions or health of the country, the first effort should be for Government to standardise the type of equipment to as narrow a range as conditions would permit, so as to assist in bulk production. It will also be necessary for Government to assist in research and maintaining of up-to-date information in regard to development in foreign countries, which should be made available to the industry readily. In short there should be close co-ordination and co-operation between Government and industry, until the latter levels up with the standards achieved in foreign countries.

9. **Factors in Production.**— *er*—There has not been suffic ently cheap electrical power available in the country in the past for industrial purposes. With the completion of Hydro-electric schemes referred to in a subsequent chapter and the nationalisation of electrical power so as to provide distribution at low costs, one of the greatest handicaps to the industry in the past will be removed.

It is hoped that Government will give special consideration to all industries in their scheme for supply of cheap power, but the needs of the electrical industry should receive special attention because of its value to the development of other industries. It is necessary to emphasise that apart from providing power at a low cost, Government should standardise machinery and equipment of all Power stations, so that the local industry gets the maximum benefit from the proposed developments.

10. **Skilled and Unskilled Labour.**—Drifting of labour is a common tendency owing to the increasing scarcity of properly trained labour. To improve efficiency and maintain a high standard of quality, it will be necessary that migration of labour is reduced to minimum possible and takes place if necessary under arrangement between the Governments concerned. One of the essentials will be to provide good residential and health facilities at all industrial centres. The Panel recommend in a later Chapter the steps that they consider Government should take for improvement of training and education of the higher technical staff. In regard to skilled and unskilled labour, however, the industry will be greatly responsible for providing adequate facilities for training, but unless measures to prevent drifting of labour are taken, any facilities that the Industry may provide will be of little benefit.

11. **Transport.**—The Railway Department generally determine freight rates on the basis of the value of goods to be transported in comparison with thei-

bulk or weight and liability to breakage A schedule is given below for facility of comparison.

Commodity.	*Rate charged per maund per mile Pies*
Battery containers, cells, bulbs, fans & components, meters, electrodes, heating and cooling appliances.	0·89
Wiring material such as ceiling roses, connectors, lamp holders, switches, etc., bus-bars, electric bells, fuse units, insulators, rubber insulated cables.	0·77
Accessories for overhead transmission lines, alternators, armoured cables, circuit breakers, condensers, motors, hard drawn copper conductors, generators, motor controllers, transformers, switchgear, welding machinery.	0·58
Wooden battens	0·42
Castings, pulleys, railings, expanded metal, agricultural implements.	0·46
Beams, bars, hoops, rails, plates, sheets	0·42
Billets, blooms, pig iron	0·38
Machinery other than electrical	0·54
Amusement machinery	0·89

It has not been possible for the Panel to collect comparative freight rates prevailing in foreign countries. The Panel is not in a position to express an opinion as to whether, from the All India aspect, the transport system could bear the loss of revenue resulting from reduction of freight rates on the items of electrical machinery and equipment. However, it is recommended that Government should undertake necessary investigations for purposes of adjustment of freight rates giving due consideration to the importance of economic distribution of electrical equipment and machinery for the essential purposes referred to before.

The transport system of the country has in the past been found to be very inadequate for the needs of the country and there is no doubt that the development of various industries will outpace the improved facilities that Government at present contemplate. Particularly as regards electrical equipment and machinery, it is necessary to emphasise that many items are of a very delicate nature and for the transport services to be of maximum benefit, it will be incumbent to provide better handling facilities than at present exist at most of the Railway stations.

12. **Raw Materials.**—It will be seen from the Chapter on "Availability of Raw Materials" that the industry is happily situated in regard to many items. At the same time, owing to lack of processing facilities, the availability of certain important items is of little benefit. In this place, it will suffice to emphasise that the development of necessary processing facilities is essential. Owing to the vastness of the country the transport system will again play an important part in economic distribution of raw materials. Long overland transport is bound to cause severe freight disadvantage to the industrial centres distantly located from sources of raw material, which can only be overcome by introduction of telescopic rates for long haulages.

CHAPTER I

Statistical Data

13. To ascertain the manufacturing targets to be aimed at by the electrical machinery and equipment industry it was essential to obtain a clear picture of

the requirements of the country. It is to be noted that there is hardly any statistical information available in India from which the various demands could be worked out. The import figures as given in the Publications for Sea-Borne Trade are the only available information. These figures are in rupee values with no mention of quantities and categories of respective equipment. It was impossible, therefore, to tell for a given category, such as electrical motors, as to what proportion of the total imports was represented by direct and alternating current motors of different types and sizes. The Government statistics with respect to products manufactured in India, with which the Panel was concerned, are fragmentary and incomplete, otherwise a picture could be obtained of the normal market for a given category by adding to imports the production in India. The importance cannot be over-emphasised of maintaining accurate statistics of imports as well as production in India, suitably classified, with details as to amounts in rupees, quantities, types and sizes. Government would be well-advised to give foremost consideration to this all-important aspect of statistics if future planning is to meet with success. These statistics would help the industrialists of the country in developing the existing industry and entering into fresh enterprises.

14. With the exception of a few items there has been very little manufacture of electrical machinery and equipment in the country. As such import figures wherever available, have been taken as a fair indication of the country's demands. The six years of war have had a very disturbing effect on the imports and its consequences cannot be stated to have passed with the end of war. During the war period the law of supply and demand could not be taken to be freely operative for the determination of these demands, and hence recourse has had to be taken to the pre-war period figures, when market conditions were more stable. This going back by six years introduces possibility of errors and it has been kept in mind when estimating the demands referred to above.

15. The only rational method of ascertaining the requirements of the country is by classifying them under four headings:—(i) Pre-war demand, (ii) Pent-up war period demand, (iii) Post-war quinquenium demand, and (iv) Sustained demand. This fourth demand is a major factor which, together with the volume of export, will determine the extent of the development of manufacture of electrical machinery and equipment in the country.

16. **Pre-war demand.**—The import data available is only in respect of a few major industries. Mere value of equipment and machinery is a highly variable factor and if such values are to be worked out to a comparable basis, it is necessary to know the yearly cost index figures for that particular type of machinery and equipment. Such direct cost index figures are not available which is a serious handicap to our investigation. However, these have been adjusted on the basis of yearly cost index figures worked out by the Panel. The index value for the years 1935-36 was taken as 100 and the import costs for the other years have been adjusted on this basis. Appendix IV gives the import values for electrical machinery and equipment as reported in the Sea Borne Trade Publications for 1935-45 and corresponding adjusted values in Appendix V.

17. **Pent-up War Period Demand.**—The corrected import values averaged out for the years 1935-39 and 1939-45 were adjusted as follows to arrive at the pent-up demand. In this calculation the pre-war average normal demand was taken to be also the average normal demand during the war period. The average imports for civilian requirements during the years 1939-45 were deducted from the pre-war average normal demand. The figures thus obtained were further adjusted for reduction caused by efflux of time, gradual change over from D. C. to A.C. supply and the Defence Service surpluses. The war period pent-up demand finally arrived in the manner stated is of great importance

for planning the development of electrical machinery and equipment industry during the next five years and is to be added to the normal demand including that for replacements, improvements, new projects, etc.

18. **Post-war Quinquennium Demand.**—As detailed in a subsequent chapter, Posts and Telegraphs Department, Railway Department, Office of the Electrical Commissioner and Office of the Textiles Commissioner, have plans for development of services or industries during the next five year period. These plans cannot be taken as final owing to certain limitations. They will need modifications depending upon such factors as availability of finance and technique and pace of development possible. Estimates are given in most cases for electrical machinery and equipment that would be required for the proposed development in the next five years. The co-related and co-ordinated estimates for these new projects form a large part of demand under this heading.

19. **Sustained Demand.**—The normal annual demand of the country after the post-war five year period, which is inflated by several disturbing factors, is taken as the 'Sustained Demand.' Importation of capital goods and machinery from abroad is at present difficult and it is likely that foreign manufacturers will continue to be engaged on home orders for the next few years, so that India's requirements will not be fully met. The same difficulty will be experienced in regard to technical aid. These factors, combined with the fillip given by Government to the various development plans and the industry as a whole, will determine to a considerable extent the needs of the country five years hence. We have attempted in this Report to arrive at 'Sustained Demand' by a rational visualisation of the factors involved.

CHAPTER II

Conditions of Trade and Industry

20. **Pre-war.**—Unlike many Indian industries, the electrical industry came into existence in India a few years after the termination of the first World War. The necessity of building up this industry was felt much earlier, but lack of technical knowledge and enterprise, combined with restrictions on the import of capital goods and machinery during the first World War, precluded the industrialists of the country from entering into the field of this industry. Though later the growing sense of the rapidly increasing importance of the industry prevailed and steps were taken for its establishment, the industry's outlook was considerably narrowed by the dumping of cheap electrical goods from foreign countries like Japan and Germany.

21. Fan manufacturing industry with the establishment of a factory in Calcutta in 1921 became the pioneer electrical industry of the country. Since then half a dozen fan manufacturing factories have come into existence. In 1921 a factory for the manufacture of cable and wires was installed in Tatanagar. The first lamp manufacturing factory was established in Calcutta in 1932 and since then eight more factories have been set up. Electric motor, transformer, insulator and battery manufacturing plants appeared long after. The output of the industries was extremely small, with the result that the country's major requirements had to be imported. Hence, before the II World War, the activities in regard to electrical machinery and equipment were confined mainly to trade The fact that many foreign concerns established subsidiaries in India would indicate that there is field for considerable business, and with the schemes referred to at a later stage the volume should increase manifold. The foreign manufacturers have to their credit experience of long years in manufacture and special facilities in obtaining raw materials at lower costs through their connections in foreign countries. We are also aware that the control of prices of many raw materials rests in the hands of giant manufacturers who have hitherto followed a policy detrimental to the interest of

undeveloped countries. Many of these foreign concerns have schemes to manufacture certain products in India and as the local industry develops, it will be necessary, to consider to what extent the activities of foreign combines would need to be co-related and co-ordinated in order to prevent any adverse effect on the wholly national manufacturing firms.

22. **War Period.**—The development of fan, lamp, batteries and insulator industries made considerable advance during the last six years. Even prior to the fall of France when the tempo of war production was low, considerable activity had taken place in the manufacture of these products in the country. With the fall of France and the urgent necessity of meeting the increasing demands of the Armies in the Middle East, supplies had to be obtained from all branches of the industry whether large or small scale. With the entry of Japan into the War, steps had to be taken to import machinery and equipment for expanding the manufacture of the above specified four industries and such industries as electric motor, transformer and cable and wire. The production of fans, lamps, batteries and L.T. insulators reached a reasonably good standard of volume and quality in the country. A more determined assistance in making available raw materials, technique and capital goods to the industrialists would have undoubtedly advanced the industry further during the war.

23. **Post-war.**—The difficulties experienced by the industry during the war have still to be surmounted. Capital goods, raw materials and technique are not forthcoming sufficiently to enable rapid growth of the industry. With the fillip given to the few industries specified above, establishment of new industries such as radio, electrical instruments, refrigerator and air-conditioning have had the consideration of large concerns during the post-war period. With an assured and continuous supply of necessary raw materials and with the assistance of Government on the lines recommended in this Report, the Post-war output of fan, lamp, batteries and L.T. insulator industries should meet the requirements of the country and leave a surplus for export to the countries on the fringe of the Indian Ocean and the China Seas, replacing German and Japanese products, which are not likely to appear in the markets for some years to come. However, foremost attention should be paid to the development and establishment of heavy electrical industries, as the expansion of industries utilising electrical power will depend largely on supply of their requirements by the indigenous heavy electrical industries. In this category the items that will need special attention are motors, generators, transformers, electric cables of wire, switchgear and refrigeration and air-conditioning equipment.

24. Certain items under the category of light electrical industries are also of importance. Radio sets and equipment, for example, have tremendous educational value. Production of a cheap and efficient unit locally should be given special attention.

25. Certain feeder industries, such as electrical steel, insulating materials and drawn and covered conductors, which are dealt with in greater detail later on, are also of extreme importance for purposes of developing the industry.

26. The industrialists have ample capital at their disposal and there is every reason to believe that with necessary assistance from Government for importing capital goods, raw materials and technique, the electrical industry as a whole would be well-established during the next five years.

CHAPTER III

Post-War Developments

27. The post-war development of electrical machinery and equipment manufacturing industry is closely linked up with the development schemes at such Government Departments and industries as are likely to utilise electrical

products in considerable quantities. A survey of these plans is essential as the extent of their electrical requirements would greatly determine the prospects for the future electrical industry.

28. **Electricity Generation.**—The availability of electric supply has a considerable bearing on the development of electrical industries. The various Provincial Governments were addressed with a view to elicit information regarding the post-war development of electric supply in their Provinces but their response was very poor. At the suggestion of Mr. H. M. Mathews, Electrical Commissioner with the Government of India, a questionnaire was prepared, which with the reply received from his Office is re-produced in Appendix VI. Though the information furnished by that Office has its limitations, it affords a valuable basis for visualising the country's requirements of electrical equipment in the light of the position set forth below:

(i) The Electrical Commissioner has furnished an analysis of electric energy generated in India during 1939. From this analysis which is given in Appendix VII, it will be observed that with the exception of Mysore, Delhi and Bombay, where the energy generated *per capita* was between 35 to 41 K. W. H., in all the other Provinces and States it was less than 10 K. W. H. *per capita*.

(ii) Appendix VIII gives a comparison of the total installed capacity in 1939 and 1946 and estimates for 1953, 1958 and 1963. It will be noted that the anticipated expansion in generating capacity is quite large. In fact, the installed generating capacity in India in 1953 and 1963 is expected to be roughly two-and-a-half times and three-and-a-half times respectively of that in 1939.

(iii) The cost of the additional generating plant likely to be installed by the end of 1953 on the basis of prices ruling in 1945-46 is expected to be Rs. 47 crores. Two-thirds of this cost would go towards the purchase of thermal electric plant and the balance towards the purchase of hydro-electric plant.

(iv) In India, there are at present 408 public electric supply undertakings with their own generating stations; of these, 100 generate direct current supply, 298 generate standard alternating current 50 cycles supply and the other four undertakings generate non-standard alternating current 25, 40 and 60 cycles supply. Over and above these, 136 undertakings receive bulk supply, 7 of which have the central distribution operating on D.C. supply and extensions on A.C. supply and the remaining 129 undertakings operate on A.C. supply. The Electrical Commissioner's Office is adopting the policy of advising undertakings to limit additions or extensions of non-standard generating plant to the minimum and of encouraging the utilities concerned to change over to the standard alternating current 50 cycles supply. They anticipate that the connected load capacity in 1953 will be 3,920,000 Kilo-watts and of this quantity not more than 7·32 per cent. will be on direct current supply, not more than 1·4 per cent. on non-standard alternating current supply and the balance on standard 50 cycles alternating current supply.

(v) In Appendix IX the Electrical Commissioner has given the actual and anticipated connected loads in the domestic and industrial categories. The figures provided in the Appendix indicate that the utility of electrical energy is expected to grow in the same proportion for all the categories during the years 1939-1963.

29. The Government of India have inaugurated the "Central Technical Power Board" comprising specialist engineers to advise on and plan new schemes of hydro-electric as well as thermal generating stations, and electric high tension transmission and interconnection of electric power systems. India has immense hydro-electric power resources. Out of a potential of about 27 million Horse Power, the power actually developed is only about 3 per cent. The Central Technical Power Board is engaged on the planning of multi-purpose development of the Damodar river and on the studies of transmission grid developments in Bihar, U.P. and Punjab. The Central Waterways Irrigation and Navigation Commission are understood to be planning the development of power resources on the Kosi and Mahanadi rivers. Various Provincial Governments and Indian States have in hand plans for development of power from rivers such as Koyna, Godavari, Sutlaj, Rihand and Poringal-kuthu in Cochin. The power stations on these rivers would be interconnected with the existing hydro-electric and thermal stations. This would enable both hydro and thermal power to be utilised to the fullest advantage of each region.

30. Large electric power systems are not economical to develop unless an appreciable amount of remunerative load can be connected to the system from commencement of supply. On the other hand, rural electrification is essential for improving the economic standard of the agriculturist. Under existing conditons it would take a period of 3 to 5 years before rural loads can be developed sufficiently to make the rural electrification scheme economical. The Governments of Bombay and Central Provinces are, therefore, actively planning "Nursery Power Schemes", which comprise of a small power station with a capacity of 200/300 K.W. with a number of 11 K.V. distribution lines energising the surrounding villages and small towns. The "Nursery Power Schemes" will in course of time be connected to a high tension transmission grid, if within a reasonable distance, or to a large power station constructed for feeding a number of areas developed by means of the Nursery Schemes.

31. The rate of growth of the generating capacity may be taken as an approximate measure of the likely growth in demand for electric power consuming devices. The availability of electrical energy at economic rates would further augment the growth of this demand.

32. **Indian Posts and Telegraphs Department.**—The Indian Posts and Telegraphs Department, have proposed expansion of the various branches under their purview. Schemes under their consideration are outlined blow.

33. **Telecommunications Development Scheme.**—During the war a large expansion of the tele-communications system in India was carried out to meet the operational and administrative needs. This scheme involved the construction of new main telegraph and trunk telephone lines between important centres in India, the installation of a long-distance telephone and telegraph equipment, the construction of subsidiary lines and installation of apparatus for secondary war centres involving a cost of Rs. 16·5 crores. This was subsequently reduced to Rs. 15 crores. It is estimated that the P. & T. Department, will take over Telecommunication Development Scheme lines and equipment from the War Department and carry out some new line constructions and equipment installations costing in all about Rs. 12 crores to form the main long-distance telephone and telegraph network for post-war development. In addition to the P. & T. main network circuits included in the Telecommunications Development Scheme, it is proposed to provide in the post-war period a more comprehensive network of 18-channel voice-frequency telegraph systems between the main communication centres in India, with 6-channel voice frequency telegraph systems joining the secondary centres to the main centres, so as to relieve congestion and reduce delays. The cost of this voice-frequency telegraph network will be approximately Rs. 23 lakhs. The telegraph network of the P. & T. Department, contains 64 Departmental Telegraph Offices and 4,062

Combined Post and Telegraph Offices with 107,000 miles of post routes carrying 616,400 miles of wire. In addition, the public has telegraph facilities available from 5,310 Railway Licensed Telegraph Offices. It is now proposed that there should be a telegraph office at all places with a population of 5,000 and over. There are about 3,800 such places in India, of which 2,300 are already provided with telegraph offices leaving 1,500 to be dealt with.

34. **Expansion of Teleprinter Working.**—It is proposed to make wide use of teleprinters in departmental telegraph offices as a step towards quickening and improving the existing service, in both the main and the secondary networks. The estimated cost involved would be approximately Rs. 45 lakhs.

35. **Pre-war Telephone Network and Future Programme.**—The Department operates some 400 exchanges with about 120,000 telephones. For a country of the size and population of India the telephone service is still very undeveloped and the number of telephones per head of population is very small. The following figures illustrate the position in other countries.

	Number of telephone per 100 population	
British India	0.02	(on 31-3-39)
China	0.04	(on 1-1-39)
South Africa	2.03	(on 31-3-39)
Great Britain & Northern Ireland .	6.77	(on 1-1-39)
Australia	9.14	(on 30-6-39)
Canada	12.13	(on 1-1-39)
U. S. A.	15.37	(on 1-1-39)

The post-war programme of the Department will cover a considerable increase in the main and secondary trunk networks, telephone exchange systems and telephone exchanges.

In the post-war plan it is proposed to provide a telephone exchange in all towns with a population of more than 30,000. There are about 450 such towns in India and 300 of these are already provided with telephone facilities. Thus 150 new telephone exchanges with an initial capacity for 100 subscribers extensible to 500 are likely to be installed. Besides these new exchanges, the P. & T. Department, have provided for the replacement of the existing manual exchanges by automatic in medium sized towns and the expansion of the existing automatic exchanges in larger towns. Provision is already included for replacement of the Calcutta manual telephone system by automatic system and for expanding the automatic systems in Madras, Bombay, Ahmedabad and Karachi. The approximate cost of automatic plant which will be required during the next 10 years is Rs. 4 crores.

36. **Air-conditioning.**—The delicate equipment used in telephone exchanges and in carrier system installations has, for efficient working, to be kept scrupulously clean and preferably at an even temperature and humidity. It has, therefore, been proposed to have air-conditioning plants in medium and large size exchanges and repeater stations at a cost of Rs. 28 lakhs.

37. **Wireless Service.**—The post-war plan of the P. & T. Department provides for the development of wireless services for telecommunications purposes. At this stage it has not been possible to estimate the exact needs but a provision of Rs. 7 lakhs has been proposed to meet the initial requirements.

38. **Line Stores.**—The policy of the Department is to continue to manufacture its requirements of line stores as in pre-war days. The capacity for line stores manufacture developed in the P. & T. Workshops during the war amounted to an increase of about 50 per cent. over the pre-war capacity and by working overtime and night shifts the outturn of lines stores was increased to nearly double that of the pre-war period. The increased capacity for manu-

facture will probably be required in full to meet the needs of post-war development.

39. **Equipment.**—With regard to telephone exchange and telegraph office equipment, there are certain items which the Department is not in a position to manufacture. It would, for instance, not be an economical proposition for the Department to make any attempt to manufacture its comparatively small requirements of automatic telephone exchange or carrier equipment which require not only a very high standard of engineering and expensive machinery but also continual and costly research. The same applies to the more complicated types of high speed telegraph apparatus. It will, therefore, be the policy of the Department as regards indoor equipment to restrict manufacture in its own workshops to its requirements of manual exchange equipment, subscribers telephone sets, and the simpler types of telegraph apparatus as in the pre-war period.

40. **Railway Department.**—The Railway Department have formulated plans for considerable development costing several crores of rupees during the next fifteen years. As various members of the Panel represented to the Chairman that despite repeated efforts, they had failed to elicit any information in respects of the requirements of the Railways, the Chairman addressed the Chief Commissioner for Railways requesting him to intimate the annual respect of the requirements of the Railways, the Chairman addressed the ment. The Panel, however, records with regret that upto the time of writing the Report, the information had not been received. It is unfortunate that one of the principal Departments of the Government vitally concerned with the inudstry of the country should have deemed fit to keep silent on this all important question affecting the indigenous electrical industries. In the circumstances the Panel had no alternative but to rely on informatoin obtained from other sources.

41. We reproduce below a statement relating to the Railway electrification projects under examination of the Railway Board:—

Railway	Section proposed for electrification	Mileage of Section
		Miles
Bombay, Baroda & Central India Railway.	Bombay Ahmedabad . . .	270
Great Indian Peninsula Railway	Igatpur-Bhusaval . .	191
	Poona-Dhond . . .	48
	Dhond-Manmad . . .	146
East Indian Railway . .	Howrah-Gaya-Moghalserai Howrah-Bandel-Burdwan .	444
South Indian Railway . .	Tambaram-Villupuram . .	83
	Chingleput-Arkonam . . .	39
Bengal Assam Railway . .	Calcutta-Ranaghat . . .	46
	Calcutta-Bongaon . . .	48
	Southern-Section . . .	37
	Total .	1,352

The E. I. Railway scheme for electrification from Howrah to Moghalserai is likely to be given first priority. The E. I. Railway have already instituted a general project survey and have been instructed to prepare detailed project in consultation with their consulting engineers.

42. It is understood that the Railway Board are not sure of adequate return on capital outlay on thermal power stations for electrification purposes. There already is a widespread public protest over the question of wasting useful coal assets by the Railways, and quite apart from this, the fact remains that the electrical industry, particularly the heavy electrical together with manufacture of prime movers in the country have to be developed. Local availability of technical advice, for which the Railway Board at present depend on foreign experts, is emphasised in this Report. These factors should in course of time considerably reduce the Railway Board present estimates for initial costs and maintenance. The Panel are firmly of the opinion that rapid electrification of the Railways will provide a considerable impetus to the local industries and the approach to the subject should therefore not be purely from the point of view of the Railway revenues.

43. The Panel note with satisfaction the announcements made by the Government in regard to the post-war Railway expansion schemes. The proposals to instal railway carriage fans in all third class compartments will enhance considerably the demand for 24 volt D.C. fans. Increasing popularity of air-conditioned compartments will necessitate the building of more air-conditioned coaches, which again works on 24 volt D.C. circuit. The proposed expansion of railway facilities over the next 10 years added to the previously stated requirements will make the volume of requirements of such electrical equipment as fans, train-lighting lamps, batteries, generators, switchgear, wires and electric fittings for the Railways very large. The Railways should be in a better position than other Departments to standardise the requirements and publish a classified list for the benefit of the electrical industry as we have stated elsewhere.

44. **Expansion of Cotton Textile Industry.**—In February 1945, the Government of India appointed a Committee to prepare a plan for the development of the Indian cotton textile industry. The Government have since then accepted with some minor modifications the detailed suggestions of the Committee for the allocation of new spindles for the various zones. Appendix X shows the detailed allocation then decided upon.

45. The Honourable Member for Industries and Supplies has since stated in the Legislative Assembly that one hundred and twenty-five new cotton textile mills were proposed to be erected in India.

> "The proposed mills had been distributed as follows: Bombay 24 (352,000 spindles); Madras 16 (325,000 spindles); Bengal 12 (264,000 spindles); U. P. 15 (437,000 spindles); Punjab 9 (213,088 spindles); Bihar 6 (151,000 spindles); C. P. and Berar 4 (119,000 spindles); Orissa 3 (75,000 spindles); Sind 4 (100,000 spindles); States 32 (708,800 spindles). The number of the existing mills was 417."

46. The Indian Coalfields' Committee have in their recommendations stated that the cotton textile mills, particularly those in and about Ahmedabad, should be converted to furnace oil instead of coal with a view to economise the coal resources of the country. It is further stated that such conversion will be Rs. 4-8-0 per ton of fuel costlier to the industry, owing to which the industry is reluctant to adopt this suggestion. Cheap hydro-electric power is the simplest solution and Government should pay special attention to making it available to large industries such as the textile industry as early as possible.

47. It is not possible to state with certainty that all the 125 new cotton textile mills will be equipped electrically but assuming that it will be the case their requirements may be estimated from the following particulars.

48. Power required for driving the various machinery installed in the above two types of mills on individual and group drive basis and number of motors required therefor are indicated in Appendix XI.

49. From the various sections given in the Appendix, it will be observed that if individual drive on all machines is contemplated a total of 156,461 motors of different capacities will be required. On the other hand if group drive, as at present existing in several mills, is adopted a total of 27,451 motors will be required. To these, 10 per cent. will have to be added to meet the demands of motors for Auxiliaries, Humidification and Air-conditioning plants. In this connection it may be noted that the modern trend of mill engineers is to change over from obsolete group drive to individual drive for better efficiency in Spinning Intermediate and Roving Departments and in Blow Room.

50. Electrical energy requirements would be of the order of approximately 600,000 K.V.A. High tension and low tension switchgear would be required in proportion to the number of motors and transformers installed. Approximately 3¼ million yards with individual drive or 600,000 yards with group drive of rubber insulated cables would be required for these mills.

51. The above figures are a rough estimate and will require modifications in the light of such factors as the type and class of machinery used and the type of electrical energy available. The electrical industry would in any case need to watch the progress of construction of the textile mills in different areas to obtain correct estimates of the requirements from time to time.

52. **Automatic Industry.**—Automobile manufacturers in foreign countries generally buy a large proportion of the components of vehicles from specialised manufacturers either in the finished or in the semi-finished state. In regard to electrical components such as dynamos, starters, distributor assemblies, wiring, lamps etc., either the complete set or at least the important components are purchased from specialists such as Lucas, Delco-Remy, Bosch etc. Even the complete wiring is fabricated into a 'harness' for each type or model in accordance with the automobile manufacturers' design, so that it is mounted on the chassis in the state received from the electrical component manufacturers.

53. It is difficult to state at this stage as to what the attitude and policy of the two pioneer automobile manufacturing concerns in India will be in regard to purchase of the electrical components for the vehicles that they will manufacture. The earlier stages of their operations will be confined to assembly of vehicles for which the components will be purchased from foreign manufacturers in the finished state, as the designs of vehicles have also been purchased under the arrangements agreed to with the foreign manufacturers. However, both the pioneer concerns have plans to develop local manufacture to maximum possible extent as and when facilities for local manufacture of components develop. It is a matter of common knowledge that automobile components are highly specialised items of manufacture. For instance the self-regulating dynamo developed during the last few years adds greatly to the convenience of the car owner, as the rate of charge of dynamo is automatically increased when the battery charge drops low. Again, the components of the distributor assembly are small in size and operate at high revolutions The voltage in the circuit being also high, the entire design and manufacture is of specialised nature.

54. There being no manufacture of automobile at present nor prospects of its developing in the near future, it should be possible for the electrical industry, by contact with the automobile manufacturers, to develop the manufacture step by step of the electrical components of an automobile in co-ordination with automobile industry. On a reference to the Automobile and

Tractor Panel, it is learnt that this Panel has emphasised the local manufacture of vehicle components for which facilities develop in the country, and the automobile industrialists have been made greatly responsible for assisting the development of local manufacture of such components as can be obtained to proper standards of quality.

55. **Agriculture.**—We have, in the introduction to the report, referred generally to the benefits resulting from electrification and cheaper supply of refrigeration and air-conditioning equipment to agriculture. A number of concerns have already announced schemes for the storage and/or manufacture of seed-potatoes, fruits, fruit syrups and juices etc. There is no indication so far of the commercial interests in India attempting to improve and increase the milk output of the country. However, the fact remains that in accordance with the "Memorandum on the Development of Agriculture and Animal Husbandry in India of the Advisory Board of the Imperial Council of Agriculture and Research, 1944", the fruit and milk production of the country needs to be increased by 50 per cent. and 300 per cent. respectively to achieve the minimum nutritional requirements of the present population. One of the essentials, as regards increasing the production of the country in these two items alone, would be to provide extensive facilities for cold storage to reduce wastes. The economic and labour conditions in the country would further tend to increase the demand for domestic refrigeration. The electrical industry in India, therefore, has before it the prospect of a considerably increased volume of trade if it undertakes to supply cheap and efficient equipment for the purposes mentioned.

56. We have chosen to emphasise two important aspects but the World food shortage conditions prevailing for a number of years and expected to continue for a long period still, would undoubtedly impress on the Indian industry the necessity of providing various other electrical machinery and equipment such as motors for pump units for irrigation and relating equipment, and portable generating equipment, etc., at an economical price.

57. **Air-conditioning.**—Before the war, air-conditioning equipment cost was so prohibitive that the necessity of installing such equipment owing to the climatic conditions prevailing in the country was not generally appreciated. The strain of work during war has given an impetus to the popularity of such equipment despite its prohibitive costs. Although the stage has not yet come when it can be confidently stated that air-conditioning equipment is in common demand, there is no denying that with cheap and efficient units made available freely its popularity will rapidly increase. It is not an industry that stands as a unit by itself, but is generally undertaken as a co-ordinated manufacture. The compressors, for example, are purchased from specialists, ferrous and non-ferrous tubes, wiring, motors and gas, etc., are also purchased likewise, and manufacturers of air-conditioning equipment concentrate on the design, fabrication and assembly of the components and the body. The local industry should be able to develop manufacture in co-ordination with foreign interests, which may be given a minor financial interest in the local subsidiary, as rapid strides have been made in foreign countries in evolving a highly efficient and comparatively cheap unit for this purpose.

58. **Other Developments.**—At an earlier stage under the heading of "Introduction", we have already emphasised the extensive utility of electricity and its machinery and equipment in various developments expected in the country. The most important factor to be borne in mind in regard to other developments is the development of cottage industries, which should receive the serious attention of the Government owing to its importance in increasing the purchasing power of an agricultural country like India. There is no doubt that Government will play an important role in such development but it is incumbent on the local industries to provide the initiative by bringing

out cheap and useful mechanical tools and equipment to assist the village craftsmen, who have in the past played a useful role in the economy of the country. In this respect it is worth quoting the example of Japan in developing cottage industries, which depended to a great extent on cheap and ready availability of electricity and electrical tools and equipment.

59. Owing to increased cost of labour, various industries such as sugar, paper manufacture, chemicals, etc., would need to utilise increasingly conveyor systems and other labour saving devices. Inadequate transport facilities and labour shortages will give an impetus to the use of cranes, hoists, etc., operated by electricity where electric current is cheap and readily available. The indigenous electrical industry, therefore, has the field and opportunity to increase popularity of such equipments, by making available cheap and efficient units.

CHAPTER IV

Availability of Raw Materials

60. We have found it essential to emphasise the aspect of availability of raw material, as by a glance at the list of raw materials required by the industry the impression might be created that the industry is in an advantageous position in this respect. Whilst a number of items of raw material may be available in the natural state, the benefit will not accrue to the industry until and unless necessary processing facilities are established in the country. In foreign countries the processing facilities are not a part of the manufacture of electrical apparatus, though such manufacturers contribute to a very large extent to research by active participation or financial assistance. The Indian industry is to make up for lost time and have to ensure proper quality products. In view of this consideration we have in a later chapter emphasised the necessity of facilities for higher technical education and research being rapidly developed. A review of the position regarding availability of materials in this chapter will no doubt make clear the necessity and advantage to the industry in particular and the country in general in developing raw material sources and processing facilities to the maximum possible extent. The latter need not necessarily be limited in its output to the requirements of the industry, as with proper development of processing facilities, it may be possible to export processed raw materials to foreign countries with corresponding benefits to the country at large.

61. **Copper.**—Copper pyrites is a principal ore of copper and is widely met with in India. The ore is available in Khetri and other places in Jaipur State, Singbhum and Barabunda (near Parasnath Hills), Sikkim State, Kumaon and Kangra Valley in the Himalayas and in the Mysore State. But in view of lack of concentration of copper pyrites in these mines the resources of India in this mineral on the whole may be considered poor. Only one mining concern in Singhbhum to-day produces about 6,000 tons of copper annually by treating about 850,000 tons of this ore, the copper content of which is about 2·5 per cent. They are manufacturers of hot rolled brass sheets rather than of copper since they are unable to compete with imported copper. They are able to compete successfully in the field of brass sheets owing to tariff protection and duty free import of zinc. So far as the electrical industry is concerned, no electrolytic copper is being produced in the country. Government should undertake extensive survey as the copper output in the country is far below the market's requirements and with the increased industrial development the shortage will be much more. The Panel is of the opinion that at least a portion of the locally available copper should be set aside for the requirements of the electrical industry and processing facilities for producing electrolytic copper developed. The production of electrolytic copper out of copper alloy scrap is possible and should be encouraged by the Government

by lifting all import duties on copper scrap and if necessary giving a subsidy to the indigenous producers of electrolytic copper.

62. Iron and Steel.—Large quantities of pig iron in the form of casting are required by the electrical industry. It generally obtains its supply of castings from specialists in the line though in some cases in India the electrical manufacturers have their own foundries. Castings produced in the country have in the past not been to required standards of quality except those made by a few foundries. The need for better class foundries in different centres of India for satisfying the demands of the electrical industry is emphasised. Pig iron for manufacture of castings is available in sufficient quantities in India but the prices have not been actuated by any planned economy for the industrial development of the country as will be readily seen on a comparison of pre-war export prices with the prices for local consumption.

63. Steel for shaftings can without difficulty be obtained to required specification from the steel producers. They normally supply it in the form of bars and sections which need to be forged, shaped and/or treated. Forging facilities are at present lacking in the country but are bound to develop, as the demand for such products will achieve increasing importance with the development of various industries. Some heat treating processes such as annealing is undertaken by steel producers. Machining, tempering, etc., is done by firms undertaking forging. The electrical industry would therefore not need to develop this as a part of their organization but should explore possibilities of other firms established in the trade equipping themselves to meet the requirements of the electrical industry.

64. Electrical Steel.—The sole present indigenous source of electrical sheet is India's leading steel company, but their present capacity is limited and is stated to be approximately 2,000 tons per annum of electrical steel sheets of different grades.

65. Whilst this may be regarded as a good start, it is inadequate for the basic requirements of the electrical manufacturing industry as it is calculated that approximately 10,000 tons of electrical sheets per annum are required for the first five year period and 20,000 tons for the second five year period.

66. It appears, therefore, that further development is most urgently required as imports of electrical sheet are almost impossible to obtain due to world steel shortages except perhaps by firms with long standing contacts.

67. It is also important that the quality of the electrical sheet steel supply to the industry should be uniform and comply with the standards required for this purpose.

68. The necessary testing equipment to achieve this uniformity of product has still to arrive at the Steel Company's Works, but with the expansion in quantity and improvement in quality suggested above India's requirements of electrical sheet steel could be met from within India's own resources.

69. Constant complaint has been made by the electrical manufacturing industry that there is only one source of supply in India for the finished electrical stampings and that this stamping firm can neither supply the quantity required nor at a reasonable price.

70. The question of quantity would appear to be tied up with the world shortage of electrical sheet combined with the stamping capacity available with the firm in question. "The position would be remedied if the Government were to take positive action to get the existing Indian source of supply of electrical sheets to increase its output or to create new sources of supply in accordance with the requirements of the Industry since individual electrical manufacturing firms generally have their own stamping presses which can produce the finished stampings required by them"

71. Under improved conditions of supply complaint in the matter of prices should also disappear.

72. **Rubber.**—The rubber output of the country being small, it has not, in the past, been in demand by tyre manufacturers, particularly those in America, as they have concentrated on bigger sources, such as Malaya and Dutch East Indies. So far as is known to us, the quality of Indian rubber would be suitable after necessary processing for use by the electrical industry. The handicap however is in regard to processing, which with the assistance of the Council of Scientific and Industrial Research should be satisfactorily developed. From the economic aspect also this would be a welcome course of action, as it would give a fillip to that industry.

73. **Mica.**—India is world's biggest mica producer. In the past the mining interests have concentrated on exports. Selection and grading of mica at source is an essential factor that so far has been neglected by the industry. The scope of the Government Inspection Departments can be widened so as to lay down proper standards of grade and quality for supply to the electrical industry. It is worth mentioning in this connection that similar steps taken by Government in respect of steel industry has enabled the public to obtain supplies of suitable quality steel certified by the Metallurgical Inspectorate attached to certain producers.

It is unfortunate however that so far no attempt has been made to produce micanite insulating materials. Establishment of an up-to-date factory for the manufacture of all types and kinds of micanite insulating products should have the immediate consideration of the Government. It is considered that the factory will not only be able to supply the needs of India but will be in an advantageous position to export the finished products to all parts of the world provided the products are manufactured to international standards.

74. Shellac.—Shellac is available in large quantities and exported. But, as in the case of mica, no processing facilities have been developed for manufacture of varnishes, etc., required by the electrical industry. As this is an important insulating material the establishment of shellac varnish industry is strongly emphasised. Here again the Council of Scientific and Industrial Research and the Lac Research Institute can render useful assistance.

75. Cotton and Silk.—Indian cotton and silk industry should be able to provide all the requirements of yarn, tape and fabric needed for the manufacture of insulating yarn in wire covering, insulating tapes and cloths. Specifications will however have to be drawn up by the proposed National Physical Laboratory for India to assist the silk and cotton mills to produce yarn, tape and fabric to correct standards. If the mills are unable to produce them to the required standards with the existing equipment, facilities should be afforded to them to import suitable machinery. With the availability of tape and fabric, factories should be established for the manufacture of insulating tapes and insulating cloths.

76. Porcelain.—This industry is at present in very elementary stages of development for purposes of high tension insulators, though in respect of low tension insulators considerable impetus to improve quality has been given as a result of war demand. Owing to handicaps of local availability and costs of certain raw materials required for purposes of processing, such as quartz and felspar, the porcelain industry has not yet achieved desired standards of quality and output. We suggest that the Council of Scientific and Industrial Research should make necessary investigations and recommendations to assist the porcelain industry.

77. Plastics.—The plastic industry has developed in foreign countries rapidly and the products are assuming such extensive usage that it may soon displace rubber, mica, shellac, cotton and silk and even porcelain, owing to

the advantage in shaping and forming on mass scale. Nylon is already being used for insulating wires instead of rubber, cotton, silk or enamel and it is reported that not only are better insulating properties achieved but that the manufacturing costs are lower. The indigenous bakelite industry should keep abreast of development in foreign countries, in which Government assistance is important. It should adopt new methods and processes for the benefit of electrical industries.

78. Insulation Oil.—Insulating oil is a highly specialised product that will be needed very extensively in the country as the hydro-electric schemes take shape. It is used in transformers and switchgear operating at high voltage. The base for this is mineral oils. Mineral oils are available in the country but it is not known whether the quality is suitable for the manufacture of high grade insulating oils. The Bangalore Institute of Science have done considerable original work in regard to hydro-electricity and should undertake further research on this subject also. It is understood from the representative of Travancore Government that oil from cashewnut shell has been found a very satisfactory medium for making insulating oil and varnishes. The State are installing plant for increased recovery of cashew shell oil and are also studying the question of providing necessary processing facilities. The representative anticipated that in course of time it should be possible to meet the entire requirements of the country in insulating oil from local sources provided extraction and processing facilities are established in the country. This question is of extreme importance to the Industry and Government should provide all the assistance possible in the connected investigations.

79. Imported Items.—Imported items for purposes of the electrical industry consist mainly of items like ball bearings, roller bearings, machine screws, press-pahn sheets, synthetic plastic varnishes and enamel etc. One company has been floated in India for the purpose of manufacturing ball and roller bearings. The American specialists, Messrs. Ford, Bacon and Davis have in their report mentioned that the Muradnagar Ordnance Factory can by additions and alterations to existing equipment be utilised for manufacture of ball and roller bearings. They have also recommended that the ball and roller bearing plant allotted to India under the "Reparations" scheme should be brought out for this purpose. However, it is not possible at this stage to state whether local manufacture is likly to develop in the near future. It is assumed that owing to the importance of ball and roller bearings for development of manufacture of electrical machinery, automobile, etc., the Panel concerned will make adequate recommendations to establish this industry. Until the industry is established, the electrical industry would need to import ball and roller bearings required for its purpose. This Panel holds the view that items of this nature, that are of general importance for development of local industry, should be imported into the country free of customs duty, till such time that local manufacture could start.

80. Quite a number of plants for the manufacture of nuts, bolts, machine screws, etc., are being installed and if the indigenous electrical industry would contact interests concerned it should be possible to make arrangements for obtaining their requirements from local sources.

81. Press-pahn paper is a highly specialised product and at present it is being imported. India has the facilities to manufacture high grade paper and since it is mainly a question of imparting required properties to the paper it is suggested that the Council of Scientific and Industrial Research and the Industrial Panel for Paper should pay special attention to the development of this widely used insulating material.

82. Before concluding this Chapter it is essential to emphasise the shortage of two vital raw materials, viz., electrical steel sheet and electrolytic copper which are at present badly needed by the electrical industry of the country. The Panel is given to understand that there is practically an embargo on the export of these two vital materials from U.S.A. and England. Till such time as they are produced in the country in sufficient quantities, the Government should assist the indigenous electrical industries by obtaining them from foreign countries by suitable trade agreements. Since India is a principal exporter of mica, shellac, manganese and chrome, Government might consider the advisability of bartering arrangements for supply of electrolytic copper and electrical steel sheets.

CHAPTER V

Proposal

83. It has been necessary in our recommendation to give a picture of pre-war position of manufacture and imports, likely post-war demand for a five year period, and the post-war position of manufacture in India. In the estimates for the post-war demands, we have indicated estimates for the second and third stages of development wherever possible. These estimates will need revision from time to time in the light of future industrial developments.

84. The targets for manufacture have been given where possible for all three periods of development, but the figures for the second and third periods may need alterations in the light of industrial development and experience gained by the industry during the first quinquennium period.

85. In our recommendation the capital costs are based on present day costs of capital goods, buildings, land etc. Adjustments would therefore need to be made in accordance with future fluctuations.

86. The requirements of capital goods for the first period of development would mostly need to be imported, but during the second and third periods, with the growth of machine tool industry in India, a considerable quantity may be available from local sources.

87. The question of availability of raw materials, tariff and location has been mentioned to cover individual requirements in respect of the particular item.

88. *Heavy Electrical Industries.*—We have previously emphasised the need for giving foremost consideration to the development of heavy electrical industries. A number of commercial interests have plans for expansion or new installation for manufacture of machinery and equipment of higher capacities. Negotiations are in train with foreign countries for manufacture of several new and improved types of equipment. The next fifteen years would see considerable development of the heavy electrical industries by commercial interests. Whilst the Panel have in their recommendations for establishment of manufacture of primary power equipment given due regard to the increased requirements of the country as a result of the various development schemes, we wish to draw the close attention of the Government to the fact that the manufacture of primary power equipment such as alternators, generators and transformers even of large capacity should be accelerated. It is visualised as very likely that the country's requirements may be far in excess of the estimates given in the report if all the development schemes make rapid progress in the next few years. At present imports are difficult to obtain and it would not be desirable to hold up schemes on that account. A big effort is needed to establish the industry on a large scale.

89. *Motors and Generators.*—(i) At present the manufacture is mainly restricted to that of from 1 to 10 H.P. alternating current squirrel-cage

motors, but the manufacture of other types and sizes of motors is contemplated by Indian manufacturers. The pre-war capacity for the manufacture of these motors of approximately 2,000 nos. per annum has now increased to approximately 20,000 nos. The average annual import of motors during the five years preceding the Second World War was approximately Rs. 38 lakhs representing roughly 30,000 nos. However, with the rapid development of electrification and industries consuming electrical energy, the demand for motors will be very considerable and constantly increasing.

(ii) The following Table gives approximate figures of imports in 1939, expected annual demand during next five years, present manufacturing capacity and the targets to be aimed at by the industry during the next five, ten and fifteen years. It may be noted that no figures have been given or recommendations made in respect of Direct Current motors and generators, as the demand for these motors and generators is small. The Panel consider that the manufacture of these motors and generators may be left to the manufacturers of alternating current motors and generators, who will develop the manufacture of direct current motors and generators if the demand justifies the same.

TABLE

——	A. C. 3-phase slip-ring motors	A. C. Fractional Horse Power Mot rs	A. C. 3-phase Squirrel Cage Motor	A. C. Motor Starters	A. C. Generators
	Nos.	Nos.	Nos.	Nos.	Nos.
Approximate imports in 1939.	1,500	3,000	24,500	20,000	2,000
Estimated annual demand during next five years.	4,500	18,000	75,000	60,000	4,000
Present manufacturing capacity per annum.	*Nil.*	*Nil.*	7,500	*Nil.*	*Nil.*
Stage I—					
Target for manufacture per annum during the 1st five years ending 1951.	1,000	3,000	35,000	40,000	1,000
Stage II—					
Target for manufacture per annum during the next five years ending 1956.	2,000	7,000	75,000	60,000	2.000
Stage III—					
Target for manufacture per annum during the third five years ending 1961.	Entire requirements of the country.				

(iii) During the first stage of manufacture the country should manufacture fractional H.P. motors and 3-phase induction motors upto 25 H.P. capacity only, (as the demand for motors of higher capacity would be limited), and

A.C. generators upto 50 K.V.A. During the second stage, manufacture of A.C. motors and generators upto a capacity of 100 H.P. and 100 K.V.A. respectively should be undertaken. During the third stage, motors and generators of all types and sizes should be manufactured.

(iv) A capital of Rs. 2½ crores and capital goods of value of Rs. 1 crore would be required for the production of motors, etc., specified under Stage I. Out of Rs. 1 crore worth of machinery, nearly Rs. 25 lakhs worth is already installed. Of the remaining Rs. 75 lakhs, equipment costing Rs. 60 lakhs would require to be imported and the rest could be obtained from Indian sources.

(v) Raw materials used by this industry primarily consist of electrical steel, electrolytic copper insulated wires and strips, C.I. castings, mild steel rods, ball and roller bearings and insulating material. Of these, to some extent electrical sheets and wires and entire insulating materials have to be imported. The manufacture of electrical sheets and wires has been commenced in the country and they should be available in volume to the industry during the next five years.

(vi) The existing import duty on a considerable part of the raw materials and components used by the industry is higher than that imposed on the finished product. The import duties on copper winding wires and electrical steel punchings are 24 per cent. and 12 per cent. respectively and that on sundry hardware, ball and roller bearings, insulation (solid) and insulation (liquid) is 30 per cent., whereas it is 10 per cent. on imported motors. This has resulted in the cost of imported materials used in the manufacture of motors in India being approximately 18 per cent. higher than similar materials used in the manufacture of the imported motors. The total cost of all materials used in the manufacture of motors is correspondingly increased by approximately 12 per cent. in comparison to the cost of materials used in the imported product. This implies a serious handicap to Indian industry when competing with the imported product and it is recommended that this anomaly be immediately removed by reducing the duty on the above specified materials to the same level as that on the imported finished products.

(vii) At present motor manufacturing factories are established in Calcutta, Bombay, Lahore, Kirloskarvadi and Coimbatore. With the extension of manufacture recommended in this report, establishment of additional factories at Bombay, Calcutta and Lahore and new factories at Madras, Bangalore, Tatanagar and Cawnpore should be considered. Generally speaking, the aim in regard to the manufacture of these items should not be concentrated volume. As facilities for electrical power become more and more extensive, the manufacture of these articles can also be spread extensively over the country; for example, factories can be established with advantage in N. W. F. P., Sind and Assam. In fact a stage may come, as these developments take proper shape, when in the interests of development of agriculture and cottage industry a widespread manufacturing scheme may become necessary. It is premature to make specific recommendations on the subject but it should receive the serious attention of the Provincial Governments in co-ordination with their schemes for expansion of agriculture, cottage industry and electricity distribution.

90. **Transformers.**—(i) The range of transformers manufactured in India covers small low tension lighting transformers upto distribution transformers of 500 K.V.A. rating and 22 K.V. on the high tension side. Only a limited number of 500 K.V.A. transformers have been manufactured and the bulk of the production, apart from the very small low voltage transformers, has been in the range of 25 K.V.A. to 100 K.V.A. and upto 11 K.V. on the high tension side. These types of transformers are used in large quantities by supply undertakings when energy has to be transmitted over long distances at a high voltage and reduced to a lower voltage at the consuming end. The pre-war

capacity for the manufacture of transformers was approximately 6,000 K.V.A. per annum. The present capacity is approximately 80,000 K.V.A. per annum, but owing to difficulties in securing raw materials it is not being fully utilised. During the five years preceding the last War the annual import of transformers was approximately Rs. 19 lakhs representing approximately 150,000 K.V.A. The post-war demand, with the contemplated increase in generating capacity and the distribution of electricity over wide areas, will be large. The annual requirements of the country in the next five years are estimated at 300,000 K.V.A. A very large portion of this would be in the range of 25 to 500 K.V.A. and voltages upto 11 K.V.

(ii) The targets to be aimed at by the industry are given in the following statement.

——	Capacity upto	Manufacture per annum
Stage I.—Target for manufacture per annum during the first five years ending 1951.	500 K. V. A. suitable for a voltage upto 11 K. V.	2,50,000 K. V. A.
Stage II.—Target for manufacture per annum during the second five years ending 1956.	5,000 K. V. A. suitable for a voltage upto 66 K. V.	500,000 K. V. A.
Stage III.—Target for manufacture per annum during the third five years ending 1961.	15,000 K. V. A. suitable for a voltage upto 132 K. V.	Complete requirements of the country.

(iii) During Stage I, the manufacture of large power transformers in the country would be uneconomical as the demand is small considering the capital costs of the manufacturing plant required for the purpose, and the Indian manufacturers having only recently started the manufacture of transformers lack necessary technique and experience. Hence, at least for the next five years or so, it will be necessary to import large power transformers. Thereafter, the existing factories should be able to take up the manufacture of these transformers and in about 15 years' time there should be no necessity for importing transformers into the country.

(iv) Capital required for the development of the industry during stage I would be small, as the manufacture of transformers would generally be undertaken by the manufacturers of motors and generators. It is estimated that capital goods of value not exceeding Rs. 10 lakhs would need to be imported.

(v) With the development normally expected in respect of this industry, the value of capital and capital goods required during Stages II and III will be insignificant.

(vi) Of the raw materials required in the manufacture of transformers, insulated copper conductors, cast iron cable boxes, mild steel sheets and low tension porcelain insulators and bushings are manufactured in the country, whereas silicon steel laminations, steel tubes, insulating materials and high tension porcelain insulators have to be imported to a considerable extent. Steps for the local production of these imported raw materials, with the exception of insulating materials, have been taken and in the course of next five years the need for import of these should be reduced.

(vii) The position in regard to import duty on transformers is similar to that in respect of electrical motors, i.e., the duties on raw materials are higher than on the finished goods, which is detrimental to development of industries.

(viii) The transformer manufacturers are at present located in Calcutta, Bombay, Lahore and Bangalore. Manufacture of transformers is generally combined with that of motors and generators and future expansion of the industry would naturally follow that of electrical motors and generators.

(ix) The actual process of manufacture of static condensors is very specialized and carried out in special air-conditioned premises to exclude dust. The sealing and impregnation also is a highly skilled operation. In other countries telephone manufacturing and cable industry generally do this type of work. No recommendations in regard to their manufacture need be made at this stage. As the manufacture of goods such as telephones and cables etc. develop in the country the manufacture of static condensors also will be automatically taken up by a suitable agency.

91. *Electric Cables and Wires.*—(i) Insulated wires and cables are among the most important engineering stores required both by the industrial as well as the civilian consumers of electric power. Insulated winding wires are used by the electrical engineering industry in the manufacture of fans, motors, transformers and other electrical equipment. Bare copper conductors and all the larger sizes of rubber insulated cables, together with paper insulated cables, are, however, almost exclusively used for industrial and power installations only.

(ii) The principal raw material used by the industry is "hot rolled electrolytic black copper rods" and before the war, they had to be imported. They are now produced indigenously in Calcutta from electrolytic wire bars imported from S. Africa, Rhodesia, U.K., U.S.A., and Canada. Of the other raw materials, tin and lead have to be imported whereas cotton yarn, fabrics, rubber and chemicals are available from indigenous sources. Highly purified lead may be available to the industry locally in the near future.

(iii) The first factory for production of cables and wires was established in 1921 in Tatanagar. Their pre-war range of manufacture was bare copper wires, cotton covered winding wires and rubber insulated cables and by 1939 they were catering for a considerable portion of India's pre-war demands of these stores.

(iv) During the war, due to increased demands from the Defence Services and Posts and Telegraph Department and also due to difficulties in obtaining requirements by import from U.K., it was found necessary to expand the capacity of the indigenous industry.

(v) A factory was established in the Central Provinces primarily for augmenting the production of bare copper conductors for meeting the very large demand arising out of the tele-communications development scheme of the Government of India. This factory has now been transferred to Calcutta where they have installed a plant for the manufacture of insulated wires and cables also. They have ordered necessary plant for the manufacture of enamelled wires and are expected to go into production within the next few months.

(vi) The Government also set up a factory at Tatanagar for meeting the enormous Defence Services demand for "D" class cable which is a special type of army signalling cable. This factory was run by the existing cable factory in Tatanagar and it is understood that the latter factory will take over in due course the Government factory with a view to convert it for production of stores required for civilian consumption.

(vii) The present production capacity in respect of various types of cables and wires is indicated below:

Description	Pre-war capacity	Actual pre-war production	Present capacity
	(per annum)	(per annum)	(per annum)
1. Bare copper conductors .	7,200 tons.	3,600 tons.	24,000 tons.
2. Rubber insulated electric cables.	20,000,000 yds.	8,000,000 yds.	40,000,000 yds.
3. Cotton covered winding wires.	200 tons.	120 tons.	800 tons.

(viii) The average annual imports, during the five years preceding the war were of the value of approximately Rs. 13 lakhs of bare copper wire and Rs. 79 lakhs of all types of cables. Our conclusions are given below against individual items.

92. Copper conductors.—(i) The entire range of bare copper wire manufacture of the total installed capacity of 24,000 tons per year of the two firms is sufficient to meet the country's anticipated demand of approximately 14,000 tons per annum.

(ii) Till about two years back, India had been importing black coper rods for drawing them into copper wire. But with the establishment of the factory in the Central Provinces, it was decided to import only electrolytic copper wire bars to be rolled into copper rods and further drawn into copper wire by that factory as well as the one in Tatanagar.

(iii) The information furnished to the Panel in regard to the costs of electrolytic copper wire bars cannot be properly verified by the Panel and is given below.

One source states:—

> "Before the war, German and Japanese cables and wires used to be sold in India at such low prices even after paying a larger rate of import duty, that no other make could compete with them in prices. The manufacture of these goods was said to be subsidised by the respective Governments.
>
> There was no evidence of any form of subsidies in the U. K. before the war and even during it. Experience of the last one year, however, shows that electrolytic copper is being subsidised by the U.K. Ministry for consumption in the home market; otherwise, a home market price of £62 per ton as against an export price of approximately £78 per ton for the electrolytic copper wire bars is unaccountable. This large disparity in price of the most important raw material straightaway places the U.K. manufacturer over the manufacturer in India, and affords him scope to import his products in India and sell them at favourable rates.

even after paying duty at 10 per cent. in the case of copper wires, and 7½ per cent. in the case of V.I.R. cables, as these rates cannot take care of such contingencies."

From another source the information is as follows:—

"Basic prices ruling in the U.K. during 1946:

Prior to 8th April 1946	£ 62 per ton.
April 8th and prior to 1st July 1946	£ 72 per ton.
1st July and prior to November 13, 1946	£ 84 per ton.
13th November and after	£ 98 per ton.

These figures are, we understand, taken from Messrs. Bagott and Thomson's Commercial Daily Reports.

To the best of our knowledge there is only one price quoted by U.K. manufacturers for electrolytic wire bars, that price also holding good for export trade. Owing to the scarcity of electrolytic copper during the last 18 months there has been an embargo on English manufacturers exporting E.W. bars since the stocks available were barely sufficient to meet home consumption."

(iv) The Panel asked the representative of the first source to give evidence in regard to costs to the Indian industry of electrolytic copper wire bars and were advised that since the outbreak of the war the Non-ferrous Metals Control, U.K. Ministry of Supply, took over control of all electrolytic copper and made it available to essential consumers. Under this scheme one consumer in India obtained initial supplies of wire bars at the rate of £62 per ton C. & F. Calcutta. Later on this price was increased to £62-10-0 per ton and again to £71 per ton though the price in U.K. remained at £62 per ton. It was stated in this connection that the price of £62 per ton for the U.K. market was only applicable to U.K. consumption and that no export of bare copper wires was allowed. Government agreed to release necessary dollars for purchase of copper wire bars in America and the then American price was £72 per ton. It was further stated that the American price as quoted in the Metal Market Bulletin from London was raised to £78 per ton whereas the prices for U.K. requirements remained at £62 per ton, which indicated that the U.K. Ministry was giving a preferential advantage to the industry engaged in electrolytic copper in the U.K.

(v) This question requires a detailed investigation through Government channels and after the costs to the electrical industry of this essential raw material is properly established, Government should take steps to subsidise the industry to ensure the required output.

93. **Aluminium Conductors.**—(i) At present steel reinforced aluminium conductors are not being manufactured in the country. During the five years preceding the last war the annual import of these conductors was very limited. Their use for power transmission lines is increasing rapidly. They are at present about 30 per cent cheaper in cost than copper conductors. With the development of hydro-electric projects, orders for approximately 2,000 tons have already been placed for these conductors and the demand will increase steadily with further development of generating capacity. It is expected that the total demand for the years 1946 to 1951 will be of the order of 15,000 tons. This figure has been based on information received from Governments of Bombay, Madras, C. P. and Berar and Orissa and from Hyderabad, Mysore and Travancore States. The requirements of remaining Provinces and States have been estimated in the light of information received regarding the developments in such Provinces and States. An estimated amount to cover the needs of certain major projects has also been added.

(ii) A factory for the manufacture of these conductors is being set up in the Travancore State with the support of the Government of Travancore. This plant is expected to go into production towards the end of 1947 and will have a capacity for producing 2,000 tons of conductors per annum. As the anticipated demand will undoubtedly be more than the quantity likely to be produced by the Travancore plant, the establishment of other plants is recommended. Suitable location will be in the Central and North-Eastern parts of the country Owing to the extensive availability of bauxite in the country and the possibility of extraction of aluminium at very low costs compared to foreign countries, it is very necessary that the Council of Scientific and Industrial Research make a special investigation for the substitution of aluminium in place of electrolytic copper, the shortage of which is a severe handicap to the industry. It is understood that more extensive use of aluminium conductors in foreign countries is probably not made on consideration of costs only. If satisfactory results are achieved as a result of the investigation suggested, it will enable the country to be self-sufficient not only in respect of the requirements of cables and wires but the country's production of copper could probably be diverted to better purposes.

94. **Rubber Insulated Cables.**—(i) As regards rubber insulated electric cables, at present the only factory in production is at Tatanagar and its annual capacity is 25,000,000 yds. but in the very near future the factory at Calcutta is expected to go into production with an output of 15,000,000 yds. per annum. India's estimated demand of these cables during the next five years is likely to be 250,000,000 yds. The country should aim at an annual production of 125,000,000 yds. during the next five years and 250,000,000 yds. during the subsequent five years. This would necessitate the establishment of further factories in other towns like Bombay, Lahore, Karachi, Cawnpore, Bangalore and Hyderabad (Dn.), where electrical energy required for these factories would be available.

(ii) For the increased production suggested during the first five years' programme, a capital of Rs. 180 lakhs would be required. Capital goods of approximately Rs. 20 lakhs would require to be imported and approximately Rs. 40 lakhs to be obtained from the Indian market.

95. **Insulated Winding Wires.**—(i) Cotton covered wires are at present produced by the Tatanagar factory but very soon the Calcutta factory will also go into production. The latter factory has imported a plant for producing enamelled wires also. The available capacity for the production of insulated winding wires is approximately 300 tons per annum whereas the annual demand during the next five years is likely to be 3,500 tons. Manufacturers of rubber insulated cables should also manufacture these wires at the rate of 1,800 tons per annum during the first five years and 3,500 tons during the second stage of five years.

(ii) Owing to the difficulty in obtaining silk yarn, silk covered wires are not being manufactured at present but attempts are being made to import right type of silk yarn. It is unfortunate that despite the existence of several mills in the country, the right type of silk yarn required for silk covered wire industry is not being produced. With proper research and assistance of the proposed National Physical Laboratory, the production of silk yarn of the correct quality, should be established.

96. **Other types of cables.**—The manufacture of other types of cables such as paper insulated, lead covered, armoured cables, cambric covered cables, etc., should be left to the normal development expected in the cable industry.

* * * * * *

97. **Switchgear.**—(i) The range of switchgear manufacture in India covers (1) knife switches and fuses including iron-clad, domestic and industrial switch-

proposals in regard to Nationalisation of the Industry in Chapter VI *infra*

gear of 15 to 200 amps. capacity, (2) manually operated disconnecting switches, suitable for a voltage upto 33 K.V., (3) simple type switchboards, and (4) fabricated switchboards. The production has so far been very limited. Almost all the components required for the switchgear are being produced in the country. Electrical instruments required for switchboards have to be imported.

(ii) During the five years preceding the last war, the cost of the annual average import of all types of switchgear was approximately Rs. 58 lakhs. The country's present day annual requirements of knife switches and fuses is approximately 400,000 Nos. and that of circuit breakers roughly 25,000 Nos. Figures in respect of other items are not available. Owing to rapid industrialisation during the post-war period the demand for all types of switchgear will increase considerably.

(iii) Local manufacture of switchgear of the value of Rs. 2 crores per annum of the four specified types is recommended during the first five years. During this stage the manufacture of circuit breakers is not recommended, as high technique will be required for their manufacture. During the second stage of five years it is recommended that all types of switchgear, including circuit breakers having a rupturing capacity of 250 K.V.A. of the value of Rs. 4 crores should be manufactured per annum.

(iv) The capital required for the manufacture of switchgear for the first five years' programme would be approximately Rs. 4 crores, out of which Rs. 125 lakhs would be required for capital goods consisting of Rs. 60 lakhs worth to be obtained from the Indian sources and the remaining to be imported.

(v) Switchgear manufacturing factories are located in Calcutta, Bombay, Bangalore and to a small extent in Lahore. With a view to meet the future increased demands of the country, further factories should be installed at the above specified place and in other towns such as Tatanagar, Madras, Peshawar, Karachi and Dibrugarh.

98. **Transmission and Distribution Poles and Pole Fittings.**—(i) Transmission and distribution poles and pole fittings are manufactured extensively in the country. During the last war, Government's demand for these increased considerably due to the expansion of tele-communications scheme. All these requirements were met from the country's resources. The small scale industry of Calcutta was largely responsible for complying with the large requirements of pole fittings. During the post-war period the demand for this equipment will increase rapidly with the development of various electrification projects. The other main demand will be from Posts and Telegraphs Department but their requirements are met by Departmental workshops.

(ii) Transmission and distribution poles mainly consist of solid-drawn steel, rivetted steel, second hand rail, wooden and ferro-concrete poles and as the manufacture of these poles and pole fittings would be undertaken by structural and hardware industry or by the cement and concrete industry, we have referred the question of development of the transmission and distribution poles and pole fittings industry to the appropriate Panels. The respective Panels will give due consideration to the location of these industries to suit the needs of the electrical industry. In our opinion their manufacture should be extensive rather than concentrated in a few centres.

99. **Insulators.**—(i) Insulator manufacturing industry has been well established in India and the factories are located in Calcutta, Bangalore, Gwalior, Delhi and Morvi.

(ii) The existing manufacturing capacity of nearly 1,000 tons of insulators per annum is largely restricted to all types of low tension insulators required by the Posts and Telegraphs Department, electrical utility undertakings and radio industry. The quality and price of these insulators compare very favourably

with those of imported insulators. Existing manufacturers are increasing their output so as to cope with the increased prospective demand.

(iii) Since the commencement of the Second World War, some factories attempted manufacture of high tension insulators. For want of suitable equipment for testing and refining of clay their products were not to required standards. Steps to import high tension testing equipment have already been taken by several factories. As the reliability of electric supply greatly depends upon the quality of insulators used in transmission and distribution lines, every assistance for improving equipment for testing and refining clay should be given to the industry.

(iv) During the first stage of five years the industry should expand its output to approximately 5,000 tons per annum of all types of low tension insulators. Local manufacture should be encouraged of high tension insulators upto 11 K.V. in the first, 66 K.V. in the second and all voltages in the third stage of development. A forecast of consumption of these insulators required very detailed investigation. The Departments concerned should prepare these estimates and advise the manufacturers so that the industry may prepare their future plan.

100. **Electrical Measuring Instruments.**—(i) Ammeters, voltmeters, watt-meters, house-service meters, power-factor meters, meggers, galvanometers, potentiometers, etc., come under the purview of electrical measuring instruments manufacturing industry. Public utility undertakings, Telegraph, Telephone, Survey, Meteorological Departments, Schools, Colleges, etc., require these in some type or other.

(ii) At present, manufacture of these instruments is in a very elementary stage in India. During the five years preceding the last war, the average annual import of all types of instruments was about 100,000 Nos. costing approximately Rs. 10 lakhs. The normal pre-war requirements of the country may be estimated at 100,000 meters of all types. With rapid development of electrification, the post-war annual requirements of meters would be approximately 300,000 nos. and these would mainly consist of house-service meters. A production of 100,000 house-service meters per annum during the next five years and 300,000 nos. during the second five years is recommended. The manufacturers of house-service meters should undertake manufacture of other types of meters. Though the demand for other types is comparatively small their local manufacture is of extreme importance in the future development scheme.

(iii) Capital required for attaining the target for the first stage would be about Rs. 25 lakhs and capital goods of approximately Rs. 15 lakhs will need to be imported.

(iv) The import of raw materials and components such as nichrome wire and magnets required by the industry should be permitted free of duty.

(v) At present small factories are installed in Poona and Bombay. Further expansion of these factories and establishment of more factories in towns like Lahore, Hyderabad (Dn), Cawnpore and Nagpur is recommended.

101. **Signalling and Interlocking Instruments.**—Signalling and interlocking instruments are mostly used by Railways and so far the demands have been met by imports. The figures in respect of these imports are unfortunately not available. Several factories in Calcutta are manufacturing with success components for this equipment as a side line. With necessary assistance from the Railway Department in securing designs, samples, etc., these manufacturers should be able to meet to a considerable extent the country's requirements. The existing electrical equipment manufacturers should be encouraged to develop its production as a side line. No difficulty should be experienced in manufacturing the equipment as specialised technique would not be needed. Additional capital and the cost of additional capital goods would not be appreciable.

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* See Chapter VI—Nationalisation of Electrical Industries *infra*.

102. **Factory Electrical Equipment.**—(i) The equipment mainly consists of electric sirens and hooters, soldering irons, electric hoists and cranes, lifting magnets, magnetic separators and magnetic chucks.

(ii) Electric sirens and hooters are produced in Calcutta and Lahore by manufacturers of electric motors and during the war the industry developed sufficient capacity to meet the very large demands of the Defence Services. With the cessation of war these demands have been considerably reduced. The industry does not require any further development and should be assisted by Government in the export of its products, which have been found to reach the required standards.

(iii) The requirements of soldering iron are comparatively very large. So far very little attempt has been made to produce them. Manufacturers of electric domestic equipment should take up their production. The manufacture does not involve special equipment or high technique.

(iv) Electric hoists and cranes are produced in Calcutta and Bombay to a very limited extent. Their production involves the assembly of electrical components like motors and switchgear with mechanical hoisting gear. The electrical and mechanical components for these are being manufactured by the respective industries. The development of motor, switchgear and mechanical industries should take care of the increased demand for electric hoists, cranes, etc.

(v) The manufacture of other items like lifting magnets, magnetic separators and magnetic chucks have not so far been undertaken. As the demand for these items will be limited, the establishment of separate factories is not called for. The transformer manufacturers should undertake the manufacture of these items. A large outlay on capital goods would not be necessary. Foreign technical assistance for designing and planning of production in the initial stages would be needed and Government should provide necessary facilities.

103. **Miscellaneous Electrical Equipment such as Furnaces, Ovens and Hospital Equipment.**—(i) This category covers a number of items some of which are highly specialised items of manufacture. Amongst the specialised items of manufacture may be taken high frequency melting furnaces, X-Ray equipment for medical purposes and testing of metals, artificial lungs, surgical equipment for hospitals and dentists such as electrical knives, etc. The minor items under this category are electrical ovens, sterilizers, incubators, hair curlers, clippers, etc.

(ii) The specialised items would require a very high standard of workmanship, technique and design and considerable research. No attempt has so far been made in India to manufacture any such highly specialised items. With the expansion of medical facilities and the industries of the country a considerable amount of this equipment would be required. It is not possible to forecast the requirements either by types or by numbers. The Electrical Machinery and Equipment Board, the formation of which is recommended in this report, should in co-ordination with Government arrange for higher technical education and research and for specialised training in regard to designing and manufacture of these items with a view to developing the manufacture at a later stage when the country would be in a position to assess its requirements on a sound basis.

(iii) Manufacture of the minor items such as ovens, sterilizing equipment, incubators, hair-curlers, etc., is not highly technical and has been attempted to a certain extent. As the demand increases, the existing industries manufacturing domestic electrical equipment should take care of it in their future expansion schemes.

104. **Electric Welding Plants and Accessories.**—(i) Electric welding plants are widely used by all factories and workshops. So far no production of welding plants has been undertaken in India. The requirements of the country are

being met from imports. Figures in respect of the quantities and values of these imports are not readily available. However, with the rapid industrialisation of the country, the demand for the equipment will be considerably enhanced.

(ii) Since the manufacture of welding plants involves manufacture of motors, generators and transformers, the motor and generator industry and the transformer industry should develop the production of these plants. The production will involve special technique, but no additional capital nor capital goods should be needed. Government should assist the local industry in obtaining foreign designs and technical assistance.

(iii) Electrodes are at present being manufactured to a limited extent in Bombay, Calcutta and Lahore and in course of time this industry will be in a position to meet the requirements of India and even export to the adjacent countries.

(iv) Mild steel wire required for the manufacture of electrodes is produced in the country. Special types of steel wires for certain types of electrodes have to be imported and customs duty on these should be abolished. Indian producers of steel are in a position to cater for these requirements, and the steel industry should be asked to arrange for it within a specified period, say five years, so as to eliminate imports, when imposition of protective duty may also be considered.

105. **Refrigerator and Air-conditioner Equipment.**—(i) The average annual import of the equipment during the five years preceding the war was approximately of the value of Rs. 15 lakhs.

(ii) With the increasing use of refrigeration plant in the development of industries as fisheries and photography and the requirements of hospitals, hotels and similar institutions, as well as of industries, the demand for refrigerators and air-conditioners will be very large.

(iii) During war, a firm in Satara produced a few air-conditioners and at present several industrialists are negotiating with foreign firms for establishing the industry in India. The development of this industry in the country will depend mainly on the initiative shown by Indian industrialists and the co-operation they are able to obtain from foreign manufacturers holding patents, without the use of which it will be difficult to operate a manufacturing unit in the country with any measure of early success. Government should take special interest in the development of this branch of the industry and give encouragement to its establishment in the larger interests of the country.

(iv) During the next five years, factories should be established in towns like Bombay, Calcutta, Mysore, Bangalore and Hyderabad (Deccan) for assembling the equipment from components imported from abroad with the exception of cabinets and motors. During the succeeding five years, the industry should be further developed with a view to manufacture all components and to meet India's entire requirements.

(v) Local manufacure of compressors would need to be developed to a very efficient level for purposes of developing the manufacture of refrigerators, air-conditioners, etc, Compressors are required for a variety of purposes such as road making equipment, garage equipment, operation of tools and equipment by compressed air, etc. The raw materials for manufacture of compressors are readily available and the required equipment also exists. The main difficulty is accurate workmanship and a high degree of finish. The panel for Heavy Machinery Industries would perhaps pay special attention to the establishment of its manufacture, as manufacturers of refrigerators, air conditioners, etc., always obtain their requirements of compressors from specialists in the line.

(vi) Apart from compressors, the raw materials required are seamless non-ferrous alloy tubes, electrical wiring, ferrous and non-ferrous sheet metal and refrigerating gases. Except for alloy tubes and gas, which are imported by

foreign firms, the other items would be available from local sources. Certain components such as thermostats and pressure equalising valves that are covered by patents, will need to be imported in the initial stages. Duty free import of all such components by local manufacturers should be allowed for assisting development of the industry. Local manufacture of components such as motors, cabinets, switches and door fittings (which are specialised types) exists or can be readily developed. The question of reimposing customs duty on the items of import should be examined during the second stage of development.

(vii) Estimates for capital outlay cannot be furnished at the present stage but, in accordance with the general trend in America where manufacture of this equipment has been highly specialised, Indian automobile manufacturers should be encouraged to develop this industry.

106. Light Electrical Industries.—It is gratifying to note that three important light electrical industries, **viz., fan, lamps and storage and dry batteries** industries are already fairly established and developed. Steps have been suggested to further develop these industries with view to meet not only the anticipated increased demands of India but also to cater for the markets of adjacent countries. Sufficient consideration, however, does not appear to have been given to the manufacture of radios, electric fittings and electric domestic equipment, with the result that most of the country's requirements are met by imports. The demand for these items is rapidly growing and the country should develop these industries.

107. Insulating materials industry, covering important materials required in the manufacture of all electrical products, has been sadly neglected. We have recommended in Chapter VI that Government should take initiative in the early establishment of this industry. The development of dairy electrical, sound recording and automobile electrical equipment industries, where the requirements are not likely to be large, may be left to the initiative of the commercial entrepreneurs.

108. **Radio Receiving and Transmitting Sets.**—(i) Several factors have impeded the growth of the listening public of India as is amply borne out by the following comparative figures of licences issued in various countries.

Country	Population	No. of licences.
India	400,000,000	200,000
U. S. S. R.	170,000,000	10,351,361
Britain	44,000,000	9,884,000
Italy	43,000,000	1,020,845
France	42,000,000	5 248,445
Belgium	8,300,000	902,445
Holland	8,100,000	410,197
Hungary	7,000,000	903,855
Switzerland	4,600,000	850,000
Sweden	6,600,000	1,900,012
Australia	7,000,000	1,500,000

(ii) The number of broadcasting stations in the country is so small that unless high powered expensive sets are installed it would not be possible to satisfy the requirements of the people, specially dwellers of villages. The following figures reveal the position of broadcasting service when compared with that in other countries.

Country	Population	No. of broadcasting stations
India	400,000,000	15 (including States)
Australia	7,000,000	139
U. S. A.	135,000,000	900

(iii) Since broadcasting is the easiest and cheapest mode of imparting general knowledge to the public, Government would do well to develop broadcasting in India. That will promote the growth of the listening public and the indigenous radio industry.

(iv) Another important factor hampering the installation of receiving sets is the prohibitive price at which both high and low powered sets are sold in the market. Government have imposed a heavy preferential duty of 48 per cent on sets imported from U. K. and 60 per cent on products of other countries. Middlemen add a large profit-margin making the cost to average purchaser prohibitive.

(v) The pre-war demand of receiving sets was approximately 30,000 Nos. per annum consisting mainly of all-wave sets of medium power. The demand for transmitting sets was confined to that from the Government and it was very limited.

(vi) The average annual import during the five years preceding the last war, of both transmitting and receiving sets, was of the value of Rs. 32 lakhs. Separate figures in respect of these two items are not available.

(vii) During the pre-war period no attempts were made to produce either receiving sets or transmitting sets in the country. At present, with the exception of one firm which has commenced the manufacture of complete radio sets excluding valves, some firms are attempting to assemble receiving sets from parts mostly imported from abroad.

(viii) The demand for receiving sets increased considerably during the war period and is constantly increasing. With the growth of electrification and installation of more broadcasting stations the demand will be very large. It is estimated that during the next five years the average annual demand would be approximately 400,000 cheap popular and 100,000 high powered sets.

(ix) The manufacture of radio sets, including all the components with the exception of valves, should be immediately taken in hand with a view to produce 400,000 cheap popular and 100,000 high powered sets per annum during the next five years and this output to be further augmented with the expansion of broadcasting service during the succeeding stages.

(x) Capital required for the establishment of the industry would not exceed Rs. 2 crores. The value of capital goods required would be small and would consist mainly of testing equipment, which would have to be imported.

(xi) As regards raw materials, with the exception of valves, enamelled, silk covered and nichrome wires and insulating materials, almost all other raw materials are available in the country. However, in the course of next five years local manufacture of enamelled and silk covered wires will be developed.

(xii) With a view to assist the industry, radio valves, which are not likely to be manufactured in the country in the next five years, should be allowed to be imported free of duty and the question of reimposing the duty should be examined after five years.

(xiii) For achieving the target aimed at during the next five years, four to five factories will be required. One factory is already set up in Bombay and the establishment of further factories in Calcutta, Karachi and Bangalore should be contemplated.

(xiv) Transmitting sets are closely allied to receiving sets. With the impetus given to the manufacture of receiving sets together with the further expansion of broadcasting service, the manufacturers of receiving sets should produce transmitting sets.

109. **Electric Lamps.**—(i) Electric lamps include general service type, telephone switchboard, automobile and train lighting lamps, torch bulbs and neon and fluorescent lights.

(ii) The pre-war demand of all the specified types was approximately 10 million per annum. The average annual import during the five years preceding the last war was of the value of approximately Rs. 28 lakhs.

(iii) The electric lamp industry was set up in India before the commencement of the second world war and its further expansion took place during the war period. The Indian production in 1938 of the general service type of electric lamps was of the order of three millions and subsequently in 1945 it increased to six millions per annum. The potential capacity of the already established manufacturers at Calcutta, Bombay, Karachi, Mysore, Patna and Shikohabad is about fifteen million lamps against India's annual requirements of nearly eighteen millions. Additional machinery has been indented for by the existing manufacturers to achieve a production of 31 million lamps per annum.

(iv) At present general service type up to 500 watts, telephone switchboard, automobile and train lighting lamps are being produced and steps have been taken to produce in the near future lamps of even higher wattage and torch bulbs. Necessary technical data are being collected for the production of neon and fluorescent lamps and in the first stage of five years India should be practically self-sufficient in respect of her requirements of electric lamps of all types.

(v) The industry should aim at producing 31 million lamps per annum during the next five years. As the existing manufacturers have already made provision for the production of 31 million lamps, the question of establishing further factories or expanding the existing factories in the near future does not arise.

(vi) Many raw materials such as gas and molybdenum wire, and component parts as caps, etc., are required for the manufacture of electric lamps and almost all of them, with the exception of some glass shells, are imported. The existing manufacturers have taken steps to import suitable machinery for manufacturing these components and during the course of the next five years, the necessity of importing these components also is likely to disappear.

(vii) The Government has recently removed the duty on imports of all raw materials and components required in the manufacture of lamps and the Panel recommends continuance of this policy.

(viii) When compared with lamp manufacturing industries established in foreign countries, Indian industry is still in its infancy and consequently the existing duty on the imports of all general service type lamps should be adequately increased to protect the growing industry at least for next few years till production is increased and cost of manufacture has been reduced.

(ix) As the anticipated production of 31 million lamps will be much more than the country's requirement of 18 million lamps, the surplus lamps should be available for export to the surrounding countries.

(x) Manufacture of valves for radio receiving and transmitting sets has not been attempted in the country so far. Identical to it is the question of manufacture of X-ray tubes and fittings. Manufacture of these items can be undertaken by the lamp industry, as is being done in other countries, but a high degree of technique and research is needed to produce these items in satisfactory quality. Manufacturers of radio receiving and transmitting sets and X-ray apparatus in foreign countries obtain their requirements from specialists, who, through research and experiment over a number of years, have evolved designs of valves and X-ray tubes of high quality. It is emphasized that manufacture should not be attempted unless the production of high quality articles is ensured and it will therefore be necessary for Government to provide facilities for training and even considerable subsidy in the initial stages of the industry.

110. **Electric Fittings.**—(i) Electric fittings play a very important part in the use of electric energy. . The manufacture of these in India has been sadly neglected. Only to a very limited extent bakelite switches, ceiling roses, cut-outs and similar accessories are being manufactured by the plastic industry at Calcutta, Bombay, Lahore and Mysore. So far very little has been done to produce polished brass lamp holders, brass covered switches, brackets and such fittings.

(ii) The average annual import of fittings during the five years preceding the last war was of the value of approximately Rs. 7 lakhs.

(iii) With the development of electrification projects the demand for electric fittings will be considerable and constantly increasing. The industry should aim at manufacturing Rs. 40 lakhs worth of fittings per annum during the next five years.

(iv) The nature and volume of these goods do not justify the installation of special plants for manufacturing them but the existing and rapidly developing bakelite industry and small scale factories could with advantage devote their energy towards the manufacture of these articles. The industry should have no difficulty in manufacturing these articles as high technique is not involved. Capital and capital goods required by the industry would be very limited.

(v) All raw materials with the exception of bakelite powder and non-ferrous bars are available in the country. Bakelite powder is being manufactured in very limited quantities in Bombay and steps should be taken by the chemical industry to establish more factories to increase its production and improve its quality. Rolled non-ferrous bars are also produced in India, but they are not rolled to sufficiently close tolerances with the result that thread cutting is made most difficult. The non-ferrous industry should develop this product with a view to satisfy the needs of electrical industries. Till such time as these are produced in the country of correct quality their duty free import is recommended.

111. **Storage Batteries.**—(i) The importance of lead acid storage battery manufacture in a nation building programme will be evident from the fact that they have a very extensive usage. Modern mechanised transport systems—rail, road, sea or air—rely to a very great extent for starting, lighting and other operations, on such batteries. Every automobile on the road has at least one battery performing the essential functions of starting, lighting and ignition. Train lighting batteries are used for lighting purposes and operation of fans. The modern applications for batteries in Railways include air-conditioning, railway signalling for track and signal circuit and switching locomotives. The marine applications for batteries are multi-farious. They assure continuity of power for lighting and wireless and carry peak loads of pumps, hoists and compressors. On naval vessels storage batteries provide for gun firing and for the propulsion of sub-marines. Storage batteries furnish current for various purposes in telephone services such as transmitting, signalling and switching, and for repeaters and tele-printers. Air-craft batteries supply current for engine cranking, radio, ignition, navigation instruments, landing gear, cabin lights

and power apparatus. In places, not served by central-station power, farm lighting batteries are generally in use. High potential batteries are in wide use in broadcasting stations as well as in radio receiving sets.

(ii) The lead acid battery manufacture was started in India in 1932. The industry's pre-war capacity was about 35,000 sets per annum but this mostly consisted of plate manufacturing and not complete batteries. With the advent of war and consequent short supply of imported batteries the indigenous industry was called upon to meet the large demands of the Defence Services. With the assistance of the factories already established the industry was able to cope with these requirements satisfactorily. These factories are located in Calcutta, Bombay and Bangalore. Recently one more large plant has been installed in Calcutta.

(iii) The combined import of storage and dry batteries during the five years preceding the last war was of the value of approximately Rs. 23 lakhs per annum. Separate figures for imports are not available.

(iv) The demand for storage batteries will considerably increase with the development of large rural electrification schemes, the establishment of motor-car industry, the post-war development of the Indian Posts & Telegraphs Department and general industrial expansion. The requirements of lead acid batteries are estimated to be approximately 150,000 Nos. per annum. The present planned manufacturing capacity is more than sufficient to meet the country's entire requirements of all types of batteries. The batteries so far manufactured are, however, mainly of the type used in transport vehicles but with necessary assistance from Government Departments like Posts & Telegraphs Department, Railways and Defence Services in the form of loan of designs and, where possible, samples, the industry should be in a position to meet other requirements as well.

(v) The industry should aim at producing 200,000 lead acid batteries per annum during the next five years. The manufacture of nickel-iron and nickel-cadmium batteries has so far not been undertaken and the existing manufacturers should be able to manufacture these batteries also. Government should assist in purchase by local entrepreneurs of proprietory rights for these types of batteries.

(vi) With the exception of one firm which has a self-sufficient plant for the manufacture and assembly of all the components, the other firms manufacture plates and assemble batteries from components mostly imported from abroad. Most of the firms have, however, already arranged for the import of capital plant and machinery for manufacturing all the components and within the course of the next two years or so the import of these components would also cease.

Lead and antimony are imported.

(vii) At present the manufacturers are handicapped by the disparity in the price of raw materials used in the manufacture of batteries prevailing in U. K. and U. S. A. on one hand and that at which they can be obtained in India. The relative costs are given below for comparison.

	Price in India	Price in U. S. A.	Price in U. K.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Lead . . . per ton	668 0 0	480 7 8	293 0 0
Antimony . . do.	5,500 0 0	1,108 1 3	1,502 10 0
Litharge . . . do.	960 0 0	628 5 2	Not known
Separators . per 100 pieces	9 0 0	2 0 0	2 0 0
Containers . per piece	9 8 0	2 11 4	4 14 6
Sulphuric Acid . per ton	290 0 0	Not known	Not known

(viii) Based on the above prices, the material cost of one 6 volt 13 plate battery works out in the respective countries as follows:—

India	U. S. A.	U. K.
Rs. a. p.	Rs. a. p.	Rs. a. p.
22 0 0	11 7 0	11 13 0

Adding duty at 37½ per cent to U. S. A. and U. K. battery costs, the respective figures will be:

India	U. S. A.	U. K.
Rs. a. p.	Rs. a. p.	Rs. a. p.
22 0 0	15 12 0	16 3 0

The above stated prices are as ruling about a year back and have since varied. However, these are good enough for the purpose of our investigation.

(ix) Owing to this handicap, the indigenous manufacturer finds it difficult to manufacture batteries at a price which will compete with the imported batteries. Government should investigate the reasons causing the disparity and assist the industry.

(x) With a view to protect the industry against competition from well established foreign manufacturers, application of protective duty on imported finished product is recommended, at least for next few years till production is increased and cost of manufacture has been reduced.

(xi) As the capacity of the existing manufacturers will be much in excess of the country's requirements, facility for export of batteries should be afforded by Trade agreements with neighouring countries.

112. **Dry Batteries.**—(i) Dry batteries are largely used in electric torches, medical apparatus, radios and such establishments as Posts & Telegraphs Department, and the Defence Services.

(ii) The first factory for the manufacture of dry batteries was established in Bombay in 1934. Subsequently another large factory came into operation in Calcutta. Besides these two factories, there are a few small plants in Lahore and Agra, which are at present in an experimental stage.

(iii) The pre-war capacity of the industry was roughly 15 million cells per annum.

(iv) During the war period, the demand for batteries from the Defence Services increased considerably and were entirely complied with by the indigenous industry.

(v) With the cessation of war, demand from Defence Services will be much less but owing to general industrial development, the requirements on the whole will be considerable and are likely to be roughly 500 million cells per annum. Sufficient capacity is, however, being established by the expansion of the existing factories to produce approximately 750 million cells per annum.

(vi) The target to be aimed at by the industry during the first stage of five years should be 750 million cells per annum.

(vii) Several raw materials such as chemicals and waxed paper and components like brass caps are being imported at present. The existing factories have made arrangements to import necessary machinery for manufacturing components, and in due course there should be no import of these components.

(viii) As regards disparity in cost of raw materials, tariff and export facilities, the dry battery industry is on the same footing as the lead battery industry, and the assistance recommended in the latter case should also be rendered to this industry.

113. **Electric Fans.**—(i) The manufacture of electric domestic fans in India was set up long before the last war and it is estimated that the pre-war capacity of the factories established in Calcutta, Bombay, Lahore and Amritsar was in the neighbourhood of 40,000 fans per annum.

(ii) During the war, with a view to meet the very large demand of Defence Services, the industry was rapidly developed. The present capacity is approximately 150,000 fans per annum which is a conservative estimate and does not take into account the production of a large number of small manufacturers.

(iii) The pre-war demand for electric domestic fans is estimated to have been between 60,000 to 80,000 fans per annum. The average annual import of fans during the five years preceding the last war was of the value of approximately Rs. 27 lakhs.

(iv) With the rapid development of electrification projects, the post-war demand for fans will be considerable and it is likely to be in the neighbourhood of 150,000 fans per annum.

(v) The industry should aim at manufacturing 200,000 fans per annum for the next five years. Additional capital goods required for the expansion of the industry has already been ordered by the existing, manufacturers.

(vi) The important imported raw materials and components are ball bearings, electrical steel sheets, insulated copper wires and insulating materials such as leatheroid, etc. Pig iron, R.S. flats, sheets and non-ferrous metals such as copper sheets and brass rods are available from indigenous sources. Since the manufacture of electrical steel sheets and insulated copper wires has already begun in the country, the import of these raw materials during the course of the next few years would be reduced.

(vii) As a very large stock of fans are stated to be awaiting disposal by the Government and as full capacity for the manufacturing requirements of the country already exists, although the free and regular supply of raw materials is not available, it is recommended that the import of the above specified types of fans may be regulated.

(viii) With the further expansion of the industry, a large number of fans would be left over as surplus and facilities for their export to the neighbouring countries should be afforded.

114. **Electric Domestic Equipment.**—(i) Electric domestic equipment includes such items as electric kettles, heaters, electric irons, ovens, etc.

(ii) The pre-war annual requirement for the equipment was small and was mostly met by imports. Owing to the negligible demand of the equipment, very little effort was made to produce it in the country. Pre-war import figures are not available.

(iii) At present a few factories in Bombay, Lahore and Calcutta are manufacturing the equipment but to a very limited extent.

(iv) With the expansion of electric supply and the availability of cheap electrical energy, the demand for these appliances would be considerable.

(v) The country should establish the industry with a view to produce Rs. 30 lakhs worth of equipment per annum during the next five years. The industry

should also undertake the manufacture of such fittings as incubators, hot air ovens, cream separators, sterilizers and other electro-medical apparatus. It should also develop the manufacture of soldering irons. Their requirements would be considerable as they would be needed by all large and small scale factories.

(vi) Capital and capital goods required for developing the industry would be very limited.

(vii) Important raw materials like copper and brass sheets, M.S. sheets, plates and rods and components such as porcelain parts and rubber insulated wires are available in the country. Nichrome wire has to be imported and should be allowed entry free of duty. The manufacture of this wire in the country should be encouraged.

115. **Automobile Electrical Equipment.**—(i) No attempts have so far been made to manufacture this equipment in the country as the manufacture of automobiles had not been undertaken. All the imported automobiles have the necessary equipment already fitted on them and any further demand for it has been in the form of replacement only. Information regarding the quantities of such equipment imported was called for from importing firms but the response has been most unsatisfactory.

(ii) Import of vehicles during six years preceding the second World War averaged annually 23,000 vehicles of different types and the replacements required would be between five to ten percent varying for different items. In some cases the percentage would even be lower than five. The annual demand of vehicles during post-war quinquennium period has been envisaged at 45,000 and even if these are manufactured in the country, the quantity of electrical equipment involved both for new vehicles as well as replacements would not be large enough to justify the establishment of a separate industry for the manufacture of these components. Should the manufacture of vehicles develop on sound lines, the industry would itself be in a position to introduce the manufacture of these auxiliary components on the lines they have developed in other countries. It may be noted that the manufacture of most of the components would require specialised high technique.

116. **Telegraph and Telephone Equipment.**—(i) The principal consumer of telegraph and telephone equipments in India is the Post & Telegraph Deptt. of the Government of India. The Railway Department and some of the Indian States consume relatively small quantities. Some mercantile firms also have private telephone exchanges installed in their offices for intercommunication between their different departments.

(ii) The Post & Telegraph Department has three workshops, one at Alipur (Calcutta), the other at Jubbulpore and the third one at Bombay. In these workshops all its requirements of telegraphs lines stores (except wire and insulators) are manufactured as also certain types of telephone subscribers instruments, Morse and Baudot telegraph equipment and so on. There are certain items of telephone exchange and telegraph office equipment, which the department is not in a position to manufacture and are, therefore, imported. The main items are (1) automatic exchange equipment, (2) high speed telegraph apparatus such as teleprinter, (3) telegraph and telephone carrier apparatus. The manufacture of the comparatively small requirements of these items not being an economical proposition the department has adopted the policy as regards indoor equipment to restrict the manufacture in its own workshops to its requirements of manual exchange equipment, subscribers telephone sets and the simpler types of telegraph apparatus as in the pre-war period. As regards line stores the increased capacity for their manufacture in the Post & Telegraph workshops during the war will meet the needs of post-war development.

(iii) The requirements of the above three items during the next ten years will be as follows:—

(a) **Automatic Exchange Equipment**:—The post-war plan of the Post and Telegraph Department provides for a number of new exchanges in small towns, the replacement of existing manual exchanges in medium sized towns and the expansion of existing automatic exchanges in larger towns. Provision has also been made for replacement of the Calcutta Manual Telephone System by automatic and for expanding the automatic systems in Madras, Bombay, Ahmedabad and Karachi. The approximate cost of automatic plant which will be required during the next ten years is Rs. 400 lakhs.

(b) **Teleprinters**:—Provision has been made in the post-war plan for 1500 new teleprinters. After making allowance for the teleprinters which will be taken over from the War Department it is estimated that 1200 teleprinters will have to be imported during the next ten years, the cost of which will be approximately Rs. 36 lakhs.

(c) **Carrier Apparatus**:—More plant has already been provided for the War Department during the last three years than will be required by the Post and Telegraph Department to meet its immediate post-war needs. The requirements of carrier apparatus during the next ten years will be, therefore, rather small.

(iv) The average value of telegraph and telephone equipments imported from the U. K. during the five years preceding the war was Rs. 17 lakhs per annum. With the post-war development envisaged above it is expected that the value of the average annual requirements will be of the order of Rs. 100 lakhs. The Post & Telegraph Department did not find it economical to manufacture this class of equipment in its worshops as its requirements were small but now that the requirements have increased considerably there is no reason why the manufacture of these equipments in India should not be a practical proposition. Automatic exchange plant forms a major portion of the equipments which will have to be imported. A factory has been started in India by the Telephone Manufacturers of India for the manufacture of small sized automatic exchanges. This firm should be able in two or three years' time to manufacture bigger sized automatic exchanges also. Carrier equipment can also be manufactured by the same firm. However, this firm is a combine of foreign interests in which indigenous capital or management have practically no place. In accordance with the recommendations made hereafter, prior to encouraging manufacture of the apparatus by the firm, Government should ensure that proper safeguards to protect national interests are introduced in the constitution of the firm. It is presumed that in accordance with the general policy in countries like England, France, etc., that unlike India are industrially advanced, firms of this type will adopt a more national structure voluntarily, failing which Government should exercise necessary pressure. In the event of such foreign concerns not co-operating with Government in the matter of changing their constitution to fall in line with the general policy, Government should take steps to establish manufacture independent of such concerns.

(v) There are some component parts of manual telephone exchanges which are now imported but which can and should be manufactured in India. Some firms in India have taken up the manufacture of some of the items, but the quality of these manufactured goods needs improvement. The Government of India should foster the industry by giving them technical and other assistance.

117. **Dairy Electrical Equipment**:—(i) Electrical equipment is used in the dairy industry for (a) production and handling of milk and milk products and (b) quality control work. In the case of former, the equipment consists mainly of refrigerating plants, refrigeration cabinets, pasteurizers, cream separators,

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See Chapter VI Nationalization and/or Government Participation in Electrical Industries.

water and milk pumps, etc. For quality control work, electrical apparatus consisting of incubators, hot air ovens, heaters, etc., is mainly employed.

(ii) At present the requirement of dairy electrical equipment is very limited but with the inauguration of rural electrification scheme and with the growth of dairy farms, co-operative milk supply organizations, dairies, creameries, etc., the demand for the equipment will considerably increase. The manufacture of the above specified items will not constitute a separate industry by itself, but industries, such as refrigerator, air condition and electric domestic equipment should develop the manufacture of dairy equipment also. No difficulty should be experienced by the manufacturers as necessary capital goods and technique would be available for this.

118. **Electrical Sound Recording Equipment**:—(i) So far the demand for electrical sound recording equipment has been so little that no serious attempt has been made to build up the industry. However, with the rapid growth of film industry, the demand for this equipment will increase.

(ii) Several attempts at copying foreign machines have been successfully made but it has not been found possible to produce these on a competitive basis. The equipment mainly consists of projective mechanism, sound equipment and stand and of these the manufacture of projective mechanism is a little intricate whereas that of the other two items is simple. As the demand for the complete equipment is not expected to be large, its manufacture should be developed as a side line by machine tool manufacturers. They should take the assistance of radio manufacturers for the manufacture of sound equipment. Additional machinery for the manufacture of the complete equipment would not be required.

119. **Insulating materials**:—The position in regard to their manufacture has been dealt with exhaustively under the Chapters on "Availability of Raw Materials" and "Nationalisation of Electrical Industries". Estimates of the country's requirements and capital goods needed for its development cannot be furnished. That large quantities will be required and necessary raw materials for its manufacture is available from local sources make it all the more necessary that Government take proper steps for developing this industry. If after investigation Government prefer commercial interests to handle this industry, it will be necessary that Government provide adequate protection and subsidy, as otherwise the electrical industry in India as a whole will be placed at a handicap as compared with foreign manufacturers.

120. **Co-operation with foreign firms**:—As will be seen from the preceding portion of the Report, there are certain industries that can develop better quality products or increase their volume of production without the assistance of foreign technicians or collaboration. However, there are many items in which the assistance of foreign interests would be essential for development of local manufacture. The nature of assistance that will be required has been mentioned wherever possible but it is essential that broad lines of policy be also laid down for the guidance of commercial interests.

121. Research and facilities for research are severely lacking in the country. The first effort should be to establish close contacts with Government, educational or commercial organizations in foreign countries that can assist in the matter. In England and America, research is generally carried out by commercial interests, and co-ordination and supervision of research work is done through the channels of associations, combines or technical institutions. Since we have recommended that Government take the responsibility of establishing proper facilities for research and education, it is suggested that the Government make extensive enquiries in various foreign countries through experts in respective lines or reputed firms of consulting engineers. Many manufacturers

are now willing to establish associate or subsidiary manufacturing organizations in Asiatic countries and it may be possible in the arrangements for establishing such manufacture in India to provide for collaboration in research also. The Panel is of the opinion that selection has not been made in the past of personnel for research of higher technical training in a satisfactory manner, and this question will be dealt with in detail at a later stage. It is here emphasised that to obtain proper co-operation and collaboration, it will be essential that the best available personnel be selected, and where certain minimum standard of qualification and experience is lacking, indifferent personnel should not be sent to foreign countries for research or higher technical education.

122. Establishment of manufacture in India in collaboration with foreign interests will naturally raise the question as to the proportion of foreign managerial and financial interests in local organizations. It is not considered practicable to lay down specific proportions or an outline of the extent to which foreign interests may be permitted to control the local industry. Much will depend on the industrial policy and attitude of the Government and commercial interests in other countries, together with the volume of trade that local industrialists can assure without appreciable deterioration in quality.

123. As a general policy, the proportion of foreign capital in local interests should be on a limited minority basis. It is likely that, particularly in the case of difficult and highly specialised items, foreign interests will not care to foster industry in this country without prospects of adequate return. The extent to which imported technical personnel should be utilised would also need to be varied according to the requirements of the individual industry. It may not always be a good policy to entirely eliminate foreign participation at the risk of not having the industry at all or postponing its establishment for a very long time. The aim should be to be independent of foreign technicians and management within a period not exceeding ten years.

124. It is worthwhile mentioning in this connection the policy followed by Russia. Each foreign technician had under him two or three Russian understudies and the foreign technician was required to train his substitute so as to turn over the entire responsibility to the selected substitute within a specified period. The foreign technician stayed in the country for a further specified period until the substitute achieved the required standard of efficiency and experience.

125. Collaboration with foreign manufacturers would involve in many cases payment of royalties for the use of patents.

126. Since Government have taken the initiative to foster the industrial development of the country, it is very necessary that Government also assist in negotiation by local commercial interests with foreign concerns in respect of any arrangements for establishment of subsidiaries or associate companies in this country. The negotiations for purchase of patent licences and working drawings could, with advantage, be channelled through some Governmental agency or Corporation associated with the proposed Industrial Finance Corporation. It should be possible to draw up a model agreement detailing the broad lines for the guidance of negotiators in such matters, so that commercial interests wishing to establish associations by direct negotiation do not plunge themselves into unhealthy enterprises owing to lack of experience or due to pressure and thus injure the broad national interests.

127. **Location of Industry.**—We have where possible suggested suitable locations whilst dealing individually with the various categories, machinery and equipment. Owing to the vastness of the country, the essential factor should be economic distribution of raw materials, particularly copper and steel, the sources for which are few and far apart. Since, the proportion of wastage from the raw to the finished product is in this industry comparatively small, dispersal will not be a handicap. In fact it is considered that by dispersing the industry over a wide area better distribution and maintenance

facilities will be possible than would be the case by concentrating production and distribution centres. Due regard must however be paid in the location of industries to such considerations as size and nearness of markets, easy defence during times of war, enterprise of local inhabitants and availability of cheap power and other indispensable facilities. Since transportation in India is very expensive both in respect of time and money, it would be an advantage to separate industries involving light tonnage from those involving heavy tonnage and locate the former in inland towns and the latter in port towns.

128. Lack of skilled labour in the vicinity, housing and other facilities will frequently discourage establishment of industry in centres that would otherwise be more suitable. Lack of housing, sanitation and medical facilities in industrial centres in India is a severe handicap and needs special attention. If Government would provide these facilities we have no doubt that suitable skilled labour can be drawn even from distant places. It is essential therefore that certain minimum standards of comforts, medical and educational facilities, etc., should be laid down for all industrial labour and where necessary provided with the assistance of Government.

129. The Map at Appendix XII specifies our recommendations in respect of establishment of electrical industries keeping in view the conditions prevailing at present.

130. **Development on Cottage Industry Basis.**—Owing to a fairly high degree of technique required in the manufacture of most of the items of electrical machinery and equipment, it may be generally assumed that development on cottage industry basis can be applied with advantage in rare cases. "The only products that may be established on cottage industry basis are domestic appliances such as hot plates, immersion heaters, electric kettles, welding irons, lamp shades, table lamps, etc."

131. The principal raw materials and components required in the manufacture of domestic appliances consist of:

1. Ferrous and non-ferrous sheet metal pressings.
2. Ferrous and non-ferrous light castings.
3. Ceramic basis and resistance wire holders.
4. Bakelite and other moulded parts for terminal connections.
5. Nichrome and other resistance wires and strips.
6. Cloth, paper and galvanized iron wire for shades.
7. Timber for table lamps.

132. Sheet metal pressings are already made extensively in the country on cottage industry basis and may be developed further by providing assistance in improving design, quality and finish. In respect of certain items, tool room equipment for dies and presses may be needed. This also can be established on cottage industry basis for distribution over specified areas.

133. Ceramic parts could be made in bulk and distributed through Government channels. The same would apply to plastic moulded parts for which factories exist in Calcutta, Bombay, Lahore and Bangalore.

134. Resistance wire and strips could be imported and distributed through Government or trade channels.

135. Cloth, paper, galvanized iron wire and timber are already readily available all over the country.

136. For purposes of maintaining uniform and satisfactory quality products, a committee of engineers should be established for making initial investigations in regard to the industry. The composition of this committee should be as follows:—

1. One electrical engineer conversant with the manufacture of electric domestic appliances.

2. One mechanical engineer experienced in sheet metal pressings and light ferrous and non-ferrous castings.
3. A representative technician from Ceramic industry.
4. An engineer experienced in plastic moulding and production.
5. An engineer from a large utility concern conversant with the requirements of the market.

137. The functions of this committee should be:—

1. To select correct sizes and types of units under each of the above items of domestic appliances.
2. To design and make necessary working drawings.
3. To prepare schedule of materials.
4. To make a complete list of parts required and classify such parts under the following headings:—
   (a) sheet metal pressing and castings,
   (b) Bakelite moulded parts,
   (c) Ceramic parts.
   (d) Nickel and micanite and other insulating parts.
   (e) Imported components.
5. To draw up specifications for the various materials and lay down minimum standards of quality and finish.
6. To specify tests by manufacturers to ensure satisfactory quality output.
7. To standardise equipment required for the manufacture of various products.

138. A directive should be given to this committee to see that the design is made as simple as possible, so as to facilitate assembly and bulk production. A little local touch in the shape and size, especially for items such as boiling kettles, hot plates, lamps, shades, etc., would be a strong point of appeal to the users of these appliances. The committee should complete the initial work expeditiously. Thereafter the Provincial and State Governments should establish Applications Committee whose functions would be mainly to keep abreast of progress and development in other countries. The expenses of such a committee could be wholly or partly met by charging a cess on the products.

139. After obtaining the report, drawings, specifications, etc., from the above committee, the Government should circulate them to the Directors of Industries of various Provinces and States with a view to elicit information from them as to what parts of the equipment could be made on a mass production basis by factories either Government or private in their territories.

140. The information received from the different Directors of Industries should be interchanged so that each one can supplement what the other cannot produce.

141. The industry should be run either by industrialists on a co-operative basis or by the Directors of Industries. They should select the best suited personnel for such type of work from among the artisans in their area and arrange for their necessary training in assembly and finish in jails, industrial schools, occupational institutes, etc. They would need to provide the artisans with tools, designs, raw materials and components for the production of chosen articles. Some of the finished articles would need to be brought to a convenient place for testing and that would be either the Electrical Department of the Province or State concerned or a local utility concern, there it would be given a thorough test, certified and stamped. The tested articles could be put on the market through the trade or a local utility concern or Government cottage industry show-room.

CHAPTER VI

Nationalization and/or Government Participation in Electrical Industries

142. **Nationalization and/or Government Participation in Electrical Industries.**—The Panel, throughout their deliberations, have generally been guided by the principle that private enterprise should be allowed fullest play in the development of electrical industries in this country and that any departure from this practice should be limited only to specific cases where the circumstances of an individual case justify, in the interests of the establishment of the industry, the adoption of a different course. The Panel, as constituted, have not given any extra consideration to the ideological or other considerations which influence public mind and Government policy in many spheres. The Panel have no desire to enter into any debatable points and have therefore decided to limit their recommendations so as to produce a more realistic report, to the sole and primary aim of earliest establishment of various electrical industries in this country on a sound basis.

143. Capital and enterprise have been coming forward to some extent in this field. With the general awakening and desire to industrialise the country, more capital and enterprise are likely to be devoted to the field of electrical industries. Yet we feel that on the whole electrical industries in the country are in their early stages and that there is room for Indian products to reach higher standards. However enterprise and capital are not likely to be forthcoming in the near future for certain sections of the industry without the active participation of Government. In the opinion of the Panel such sections, the establishment of which are essential and of basic importance for development of the industry as a whole, and more particularly where Government are the chief consumers, it is necessary that Government control or enterprise should step in at this stage. The following is the list of industries which fall under this category.

144. **Telephones, Telecommunications, Teleprinters and relating equipment.**—Government have adopted the policy of taking over commercial interests operating telephone and telecommunication services. The local manufacture of all equipment for such purposes should be established by Government on an economically sound basis. Government being practically the only purchaser of such equipment can accurately forecast their requirements over a long period and by acquiring rights to manufacture locally up-to-date equipment developed in foreign countries, can maintain a high standard of service at an economical cost. Government have, during war more particularly and even in peace-time, manufactured many items of such equipment in the telegraph workshops at Calcutta and have established similar schemes at Jubbulpore and Bombay presumably in consequence of benefits derived from past experience. It is not known whether Government's efforts to manufacture such equipment have been a commercially sound proposition, but we have no doubt that with the increased demand resulting from the schemes for expansion that Government have, they can establish the manufacture of telephone, telegraph and telecommunication machinery and equipment on a sound basis. This will lead to considerable indirect benefits to electrical industry and the country in general.

145. **Signalling and Interlocking Equipment.**—Manufacture of this also can be readily developed in the Railway Workshops by Government, as Railways are the main consumers and already have a nucleus organization that can be suitably expanded for manufacture of such equipment. Very little is known to the public in regard to Government's methods to commercialise such manufacture. It must be emphasised that for the scheme to be successful, the manufacture should be established so that proper standards of quality and efficiency are maintained at economic costs.

146. **Insulating Materials.**—This industry is in a very undeveloped state and it is necessary in the national interest that it should be started with minimum possible delay. In view of complications such as patent rights, continuous research, and heavy financial investment without prospects of proper return in the near future, commercial interests are not likely to undertake its development in the near future. Being a feeder industry, the future development of manufacture of electrical machinery and equipment will depend on local establishment of the industry on a sound basis. It is necessary that it is established under Government's aegis and commercial interests given a voice in respect of costs of manufacture, quality and distribution. This covers the following items:

Tapes, cloth and tubings.

Fibre, leatheroid, insulating paper,

Press-pahn paper,

Varnishes and oils.

Cable jointing compounds.

Mica and micanite products.

147. **Cables and Wires:**—There are some firms in India manufacturing cables and wires. However, their capacity is too small to meet the requirements of the country. Large quantities of cables and wires will be required in the future development of the country, both by Government and Commercial interests, and hence their manufacture should be encouraged and controlled by Government in the larger interests of the industry as a whole. Electrolytic copper and insulating materials are required in the manufacture of cables, wires, etc. We have at an earlier stage dealt with the question of development of processing of raw materials and the difficulties relating thereto. We are convinced that as a natural sequence further expansion of the industry should be undertaken either entirely by Government or interests largely controlled by Government by active participation. Economic supply for industrial purposes and high standard of quality are essential in these products.

CHAPTER VII

General Recommendations

148. Questions of subsidy, protection, preferential treatment, technical advice, research, etc., have been dealt with in the Chapter headed "Proposals". We specify here the broad lines of policy in respect of these for the guidance of Government. It is recognised fact that the country is industrially in a very backward state. In any scheme of future development the progress made by other countries over a period of several years would have to be achieved in a much shorter period. The additional handicaps arising from lack of top technical personnel, research facilities and the dependence on the imported specialised equipment, design, etc., add to the difficulties in establishing the industry on a sound commercial basis. There is no doubt, therefore, that assistance from Government in the shape of subsidy, protection, provision of facilities for specialised technical advice, research, etc., will play an important part. We have generally followed the policy of encouraging commercial enterprise and recommended initiative by Government only in such cases where the prospects of early return on investment and labour are not very attractive in the beginning and so commercial entrepreneurs would be reluctant to develop them. In countries like Canada, many industries have developed with the assistance of commercial interests in neighbouring friendly countries. In the case of India, its physical remoteness from the industrially advanced countries is a further handicap but it is hoped that by the increased facilities for air travel together with establishment of relations on a more equitable and rational

basis with highly industrial countries such as England and America, it will be possible to establish an interchange of technical knowledge, personnel and facilities.

149. **Subsidy, Protection and Preferential Treatment to Indian Industry.**— It is difficult to make a general recommendation for the grant of protection, subsidies, or preferential treatment to Indian industries at a time when world opinion, at least in the advanced countries, is veering round to a freer exchange of goods and removal of trade barriers. While India should aim at the achievement of this goal, placed as we are, we cannot shut our eyes to the realities of the situation which warrant that adequate and scientific protection should be given to some of the electrical industries, the fostering of which is essential both in the larger interests of the country and for defence. Discriminating protection, limited to a peirod of years, is what we recommend to be the best course to adopt. In the interests of the consumer and in order to stimulate the adoption of efficient methods of production by industries, both the grant of protection and its continuance should be subject to periodical checks by competent authority like the Tariff Board. While we are in favour, under the present conditions of granting protection, we also are not less conscious of the interests of the consumer or the great need for avoiding the tendency in protected industries to follow uneconomic methods and to lag behind in the struggle for improving their methods of production and cheapening their costs. The protection we command should therefore be of a temporary nature limited to a period of years, depending on the circumstances of each industry, after which the position should be reviewed carefully. The industrialists of the country should take extreme care to plan for expansion or new installations in a thorough manner, and devote all the energy possible to develop the industries undertaken by them rapidly and co-operate with Government to eliminate protection and assistance within as short a period as possible

150. There are certain industries particularly in respect of raw materials processing, etc., that probably will remain a burden to the Government for a long period but there is no doubt that with proper planning and co-ordination, the financial encumbrances will steadily reduce, so as to be inconsiderable compared to the advantages gained by establishment of basic and key industries in the country. Bearing in mind the factors involved we recommend that there should be an organisation established by Government for keeping constant watch on the industries receiving substantial assistance from Government to ensure that manufacturing costs are steadily reduced and that constant improvement is maintained in respect of design, quality, workmanship and standards of efficiency. The industries should realise that India can raise her standard of living only by increasing production, lowering costs and prices and extending markets.

151. The Panel is of the opinion that existing machinery and procedure of the Indian Tariff Board suffer by comparison with those elsewhere, firstly in regard to the temporary nature and secondly in regard to absence of power to initiate and sponsor changes suo moto. With a view to render prompt assistance to the growing industries of the country, the Panel strongly recommends the establishment of a permanent Tariff Board to which references may be made direct without the need to make an approach through other Government channels at all stages.

152. The India Government have for a number of years adopted the policy in regard to their purchases of giving preference to Indian products and it is emphasised that this policy should be continued. In the initial stages the products of Indian industries would need a certain amount of latitude by accepting lower standards of quality and workmanship but by periodical changes of specifications and testing standards, etc., the Indian industry

should be helped to maintain steady improvement. Further, Government should not enter into any long term commitments for purchase of materials required in connection with railway expansion, power development, etc., with foreign interests. Where, after thorough investigation, Government are satisfied that supply from local sources would not be possible within a reasonable period, it may be advantageous to enter into long term commitments but the possibilities of assisting the local industry by such suppliers should be explored. Government should give the widest possible publicity to its requirements for post-war development in all its branches with a view that the local industrialists prepare themselves to meet such requirements from the country's production to the maximum possible extent. The requirements should be so grouped that individual industries can readily adjust its production to meet them.

153. **Higher Technical Education and Research.**—The existing facilities in the country for technical education and research are known to be of a very poor standard and entirely inadequate for the needs of an industrially growing country. The educational facilities available in Indian Universities and Indian Institutions for electrical engineering come to the diploma standard and not to the degree standard of foreign Universities. This is a consequence of the educational policy followed in this country for many generations, but with the new vision of an industrialised and free India, the Panel strongly feel that it is essential for the purpose of industrialisation that the standard of education in this country be so raised that the products of our Institutions and Universities do not compare unfavourably with the products of foreign Institutions and Universities. This may involve importing temporarily a large number of technical experts and professors, but this price should be paid in the interest of general development.

154. Modern electrical industry is based on research and fabulous sums are spent every year by electrical institutions in Europe and America. With the Indian electrical industry still being on a small scale and in early stages, it would be difficult to expect it to undertake research on a vast scale or a comparative basis. It is therefore essential that the national laboratories which are likely to be set up by the Government should take care of this aspect of the problem. This should not, however, absolve the industrialists carrying their share of the burden. We cannot but emphasise, with all the strength and conviction at our command, that unless India invests more money in research and education it will be in vain to look forward to any era of industrialisation in this country.

155. While on this subject, the Panel feel that some liaison should be established between research in foreign countries in the electrical industry and research that may perhaps be carried on in Institutions in India. As overlapping should be avoided as far as possible and a problem that has already been solved in foreign countries should not be taken up again, recourse in such cases should be had to gain the knowledge by suitable arrangements with foreign firms and by using India's unique position as supplier of raw materials and as markets in foreign industrial countries for bargaining.

156. As we have stated at an earlier stage, the selection of trainees for research and higher technical educations has in the past not been made in a satisfactory manner. Dependence on examination results is not a reliable procedure for selecting the best available material. Admission to the technical institutions should be made on the basis of the prior educational career of the individual and the best available candidates should be encouraged to take up technical career rather than other remunerative services at an early stage in their life. Technical education is expensive and in the interest of drawing the best students without fear of a prolonged expensive training, scholarships should be generously given to deserving candidates. The progress of every student should be closely watched both in theoretical and practical work so

that the student's attention is diverted at an early stage to specialising in manufacture design or research in accordance with the aptitude shown by the student. The Panel are aware of Government's proposals for regional technical institutions and emphasise that their establishment should be hastened.

157. The American experts have emphasised the complete lack of "know how" amongst the technicians of the country. "Know how" is defined in their report as:

"The intimate knowledge of the most practical means under any given, condition to produce in quantity at lowest cost and involves knowledge of methods of processing, tooling and designing of jigs and fixtures, the lay out of equipment and the provision of labour saving devices, the designing and setting up of proper controls of production and inventories; the organisation of supervisory personnel and laying down lines of authority and responsibility."

158. It will be seen that it is very essential to take care of this factor at every stage in technical training, research and co-ordination.

Technical Advice and Personnel type

159. **Purchasing Agency for Patent Rights.**—The American experts Messrs. Ford, Bacon and Davis, U.S.A., who were asked by the Government of India to report on the 'Manufacture of Industrial Machinery and Equipment in India' have stated as follows:

"Industrialisation in India would be expedited if the designs worked out in other countries could be secured for manufacture in India with such modifications as may be necessary to adapt the products to the peculiar conditions existing. Many products are protected in other countries by patents but generally it is possible to negotiate for the use of patents, licences and to acquisition of working drawings and specifications. It would seem, in order to facilitate negotiations for such rights and privileges, that they should be channeled through some Governmental agency rather than to let each industrialist carry on individual negotiations, We think, therefore, it is of great importance to your overall plans that such an agency be formed."

160. The Panel entirely agree with the above view. However, it is possible that in many cases negotiations already instituted individually by local industrialists may have advanced far too far for Government to intervene at this stage. This would not eliminate the necessity for establishing an "Industrial Corporation" for the purposes of negotiating the purchase of designs, patents, licences, working drawings, etc. The local industrialists who have already made satisfactory progress in their negotiations may be allowed to finalise their arrangements without Government intervention if they so desire.

161. We have suggested at an earlier stage that Government should draw up a standard agreement or broad basis of agreement giving due regard to the interests of the country so as to prevent foreign interests taking root locally to the detriment of the industries in the hands of the nationals of the country. This Panel recommends establishment by Government of an Industrial Corporation in which commercial interests should have adequate voice. The functions of the Industrial Corporation will mainly be to provide necessary capital, where capital from commercial sources is not forthcoming readily, after satisfying themselves that assistance from foreign interests is essential and that the arrangements by local interests are commercially sound. It may become a tendency in the country to draw foreign capital and management with nominal local interests and establishment of such organisations should be definitely discouraged.

162. **Consulting Engineers.**—In many highly developed products involving high degree of technique and complicated process of manufacture, there will be need for constant reference to experts on technical matters. There will be

many industries such as manufacture of X-ray equipment, television, electrical microscopes, high frequency furnaces, etc., in the manufacture of which advice from expert consulting engineers will be of considerable assistance. Government should therefore make necessary investigations and appoint specialists in the form of foreign concerns or individual technicians, or a Board of technicians to which the industry could make reference at various stages of the development to overcome the difficulties they may experience. Whatever the organisation the essential factor should be that they are able to advise on both design and manufacturing difficulties and in some cases also in investigating suitability of raw materials available from local sources. It is not necessary to enumerate the type of products or specify the nature of technical assistance, as much will depend on the extent and competence of technical assistance and personnel employed by industrialists in the organisations they set up.

163. **Availability to Trade and Industry of Expert Advice from Government Personnel.**—We have suggested in the preceding paragraph appointment of consulting engineers which would naturally be a somewhat expensive set up. However, Government can make available to the trade and industry expert advice from personnel, employed in their organisation for normal development. For example, in connection with hydro-electric expansion, Government have provided training abroad of their officers at considerable expense to public exchequer. There is no reason why the Department concerned should not so arrange the training and selection of their expert personnel, whether of local or foreign origin, that such personnel be capable of providing technical assistance to trade and industry also. Somewhat similar scheme should be possible in respect of telephone, telecommunications, teleprinters, radio, signalling and interlocking railway equipment as the Departments concerned normally need to engage experts for efficient management. The Panel is therefore of the opinion that Government should make necessary provision in their future schemes and announce to the public the nature of assistance that such personnel can provide wherever satisfactory arrangements are possible. For example Government can provide considerable assistance to the electrical industry by manufacturing for them taps, dies and gauges, etc., in the Ordnance Factories which are at present the only suitable organisations in the country capable of manufacturing these products.

164. **Specifications and certificates.**—The proposed Indian Standards Institution should co-ordinate the Indian Stores Department, Indian Railways and Ordnance Specifications and draw up Indian Standards Specifications, which should be exclusively followed by all Government Departments and industrial concerns. The Institution should endeavour to standardise finished products so as to meet the climatic and economic conditions of the country together with maximum utilisation of locally available raw materials.

165. The Panel notes with satisfaction that the Government have decided to establish a National Physical Laboratory in India. This organisation can be a nucleus for establishing extensive research and assisting in standardising suitable designs, specifications and raw material substitutes in accordance with the needs of the country.

166. In addition there should be an Inspection Organisation as an extension of the existing Inspection Wing of the late Indian Stores Department, for certifying the quality of certain Indian products. This inspection, together with extensive publicity to educate the general public to insist on certain minimum standards of quality, will give considerable impetus to improving the quality of the Indian products. It will therefore be necessary for the Inspection Organisation to undertake inspection and certification on behalf of commercial organisations. This is being done to a certain extent in respect of supplies of steel and has been found to be of considerable assistance in educating the public to call for proper quality of steel for the purpose required.

Initiative by Government:

107. **Electrical Machinery and Equipment Board.**—(i) It will be seen that there are many difficulties and handicaps in giving practical shape to the Panel's recommendation. The Panel is of the opinion that the development of the industry should be actively and persistently followed and certain amount of technical assistance should be readily available as and when difficulties are experienced. With this object in view the Panel recommends establishment of an Electrical Machinery and Equipment Board under the auspices of Government.

(ii) The Board should have the following two Panels: (i) Light Electrical Industries Panel and (ii) Heavy Electrical Industries Panel. The members of the Board and Panels should be drawn from industrial associations, the proposed National Physical Laboratory for India, Indian Standards Institution and such other organisations as are vitally interested in or connected with the development of electrical machinery and equipment industries of India.

(iii) The Board should be an advisory body to the Government in regard to policies to be adopted for the development of electrical machinery and equipment industries. Government should also utilise this agency in exercising necessary checks on production costs, standards of quality and workmanship, investigations in regard to raw material substitutes, etc.

(iv) We have already elsewhere pointed out the appalling lack of statistics in the country and it should be one of the essential functions of the proposed Electrical Machinery and Equipment Board to advise Government on the form of statistics to be maintained in respect of production, import and export. The collection and publication of such statistics will still be the function of the present Government organization. However it is suggested that facilities should be provided to employees of industries to obtain training in the matter of collecting statistics. This we understand is the practice of the Board of Trade in England. Statistics for imports, exports and local production should be maintained not only in rupee values but also in numbers or weights by specified types and classes of machinery and equipment.

168. **Transport.**—The existing system of freight rates on raw materials and finished products is presenting difficulties to the electrical industries in the way of excessive incidence of freight costs arising from long haulages. We strongly recommend introduction of telescopic and sliding scale of rates for long haulages related to quantum of materials offered for despatch every month. Railways should also provide better siding and handling facilities in industrial centres as stated before.

169. **Deputation to foreign countries.**—It will be seen from our recommendations that considerable assistance from foreign countries is needed for the establishment and development of indigenous industries. Whilst it will be essential to establish individual contacts after the initial stages of planning are over, the Panel is of the opinion that considerable initial work and establishing of friendly relations would be achieved by sending a deputation of industrialists, educationists, technicians and scientists connected with electrical industries to foreign countries. The members of this deputation should be conversant with the needs of the country in respect of raw materials, equipment, technical personnel, etc.,

The deputation should study and make recommendations on:

(a) Suitable schemes for providing technical education and research facilities in India.

(b) Arrangements for obtaining raw materials, equipment, technical personnel, etc., from foreign countries.

(c) The American experts have emphasised the lack of "know how" and the deputationists should make a special study of how such knowledge can be developed in this country, and

(d) Such other functions as Government might consider proper.

170. **Time-Table for the First Five years' Development.**—The first five years' plan for the development of electrical machinery and equipment industries as can be visualised today is outlined below. The first two years will have to be a preparatory period during which most of the preliminary work of orienting the line of development of new industries, establishment of Indian Standards Institute, National Physical Laboratory for India, Testing Laboratories, etc., will have to be taken up. Starting from the third year the concrete results of planning will manifest themselves in increased production and the variety of manufacture.

171. **First year.**—1. Formation of an Electrical Machinery and Equipment Board to assist the Government.

2. Government to collect factual data in details regarding imports, exports, productive capacity of the country, actual production, etc.

3 Early establishment of suitable technical educational institutions, the National Physical Laboratory for India and Testing Laboratories, etc.

4. Establishment of the Indian Standards Institute for drawing up specifications and establishing standards.

5. Examination of existing Tariff Policies and incidence of import duties and granting of protection and subsidies to indigenous electrical industries.

6. Ordering of most of the capital goods required in case of certain industries.

7. Importing of necessary technical personnel from abroad

172. **Second Year.**—1. Surveying the work done during the previous year and appraising the value thereof. It should be better to correct the faults and revise the policies during the initial stages of development rather than allow the mistakes to accumulate over a long period of time. This survey should be made every year and duly reported.

2. A survey of the installation of the capital goods ordered during the previous year.

3. A survey of the work done by the various Institutes established during the first year.

173. **Third, fourth and fifth years.**—As a result of the work done during the first two years it should be possible to complete the erection of new plants and begin production at least during the third year, if not earlier. The Government Agencies like the National Physical Laboratory, Testing Laboratories, etc., should also be able to give more help to the industry during the third year. In fact, starting from the third year the concrete results of planning should become manifest.

174. During the third year it should be possible to make preliminary plans for the second five-year stage and it should be possible from the experience so far gained to arrive at definite ideas about future planning.

CHAPTER VIII

Summary of the Report

175. Electricity has a wide application for domestic, industrial, agricultural, sanitation and medical purposes. Hence it is of fundamental importance in the larger interests of the country that the industries connected with generation and utilisation of electricity are developed to the maximum possible limits.

176. The basic requirements of power, labour and transport facilities exist and there is considerable scope for their development. In regard to raw materials lack of processing facilities can be overcome by proper planning and Government participation. It is necessary that an integrated programme of development of power, labour, transport together with technique and education is introduced with minimum possible delay so as to establish a key industry of such importance in the country with minimum possible delay.

177. For purposes of proper planning it is necessary that statistical data is readily available and its complete lack has been a serious handicap to the Panel. The Board of Trade in England maintains statistics, technical data and contacts with research developments for the benefit of the industry. It is suggested that Government Organization in India should take up similar responsibilities in these matters. The survey by this Panel, has owing to lack of statistical data, been confined to estimates arrived at on a rational basis in respect of the post-war demands.

178. The Panel have, for purposes of their investigation, classified industries in two categories, viz., (1) Heavy Electrical Industries and (2) Light Electrical Industries. Both categories of the industry are in a backward state despite the impetus of two World Wars and considerable interest shown by commercial enterprise Only certain sections of the industry such as lamp, fan, battery, electric motors and transformers have come into being but further developments on sound commercial basis is possible only through assistance and participation by Government, particularly in respect of processing of raw materials and manufacture of insulating materials.

179. Increased electricity generation together with improved telephone, telegraph, tele-communication and transport services, expansion or establishment of new industries such as cotton-textiles and automobile industries, and agriculture will provide ample scope for the products of the electrical industry in India. Government should make available to the industry details of their requirements classified by types, quantity and target datas so that the Indian industry are in a position to formulate their plans to meet these requirements.

180. The Heavy Electrical Industries have been given the first priority in the development programme specified by the Panel so that the expansion of other industries like electric supply, railways, telephones, telegraphs, etc., is stimulated. The Panel have been unable to obtain necessary data in respect of all industrial developments. Capital requirements for a few industries, where such data was available, amounts to approximately Rs. 8·5 crores and that of capital goods to approximately Rs. 3 crores. A better idea of capital requirements will only emerge after the first five year period which is on the anvil.

181. In respect of Light Electrical Industries, development in the past has largely, due to competition from countries like Germany and Japan, been very poor and unsatisfactory. Manufacture of a few items under this category can be established on cottage industry basis. Whilst we have indicated such items as lend themselves readily to manufacture on this basis, actual selection and establishment of manufacture will rest with Government. Here again, it has not been possible to frame accurately estimates of capital requirements on the data made available. It is estimated that for some of the industries the capital requirements shall be in the region of Rs. 2 crores. Requirements of capital goods under this category will be relatively small as considerable development can take place on cottage industry basis. Certain industries such as manufacture of valves, X-ray equipment, air-conditioning, cold storage and refrigerating equipment would require large capital and capital goods but the Panel is not in a position to furnish any estimates for the same.

182. Owing to the industrial backwardness of the country the Panel recommend the grant by Government of assistance in the form of protection, preferential treatment or subsidy. The Panel have, however, in their recommendations emphasised that such benefits should be restricted to a specified period subject to the periodical re-examination of the position. It is necessary that the industrialists keep abreast of progress in foreign countries and not lag behind in their methods of production or manufacturing costs so as to be a burden to the consumers. For this purpose facilities for extensive and efficient high technical education would need to be provided in the country as soon as possible. Adequate top technical personnel for purposes of research and development of the industry should, where necessary, be imported but the aim should be to eliminate same in as short a period as possible. The Panel recommend that Government should provide facilities for research on an extensive scale in co-ordination with the industry, as the electrical industry of India in the present state cannot afford the capital required for research and new developments on a scale that foreign countries are in a position to do.

183. The products of the country have hitherto not been of high standard of quality and Government should arrange to draw up standard specifications and provide extensive facilities for inspection and certification so that constant improvement in the quality of indigenous products is maintained.

184 The Panel have recommended establishment of Electrical Machinery and Equipment Board with a view to stimulate development and facilitate co-ordination between Government and the industry

185. The targets for development specified in the body of the report are summarised in the attached statement together with the Panel's recommendations in regard to tariff, subsidy, or other assistance.

By the unanimous consent of the members.

New Delhi,
The 23rd April, 1947

G. M. MOHAMMED,

1	2	3	4	5	6		7	8	9
Industry	Estimated annual consumption during the first five year period	Present annual production capacity	Annual Production target to be aimed at during the first five year period	Capital required for production recommended during the first five years (In Rs.)	Capital goods required for production recommended during the first five years		Tariff or subsidy	Factories exist in	Further factories to be established in
					To be imported Rs. (a)	To be obtained locally Rs. (b)			
1. Motors and Generators:									
(a) A. C. 3-phase slipring motors	4,500 Nos.	..	1,000 Nos.	2½ crores	60 lakhs	15 lakhs	Duty on raw materials to be reduced to the level of finished product	Calcutta Bombay Lahore Kirloskarvadi Coimbatore	Calcutta Bombay Lahore Bangalore Tatanagar Madras Peshawar Karachi Dibrugarh
(b) A. C. fractional H.P. motors.	18,000 Nos.	..	3,000 Nos.						
(c) A. C. 3-phase squirrel cage motors	75,000 Nos.	75,500 Nos.	35,000 Nos.						
(d) A. C. starters	60,000 Nos.	..	40,000 Nos.						
(e) A. C. generators.	4,000 Nos.	..	1,000 Nos.						
2. Transformers	300,000 KVA	80,000 KVA	250,000 KVA	Very limited	10 lakhs	...	Do.	Calcutta Bombay Lahore Bangalore	Calcutta Bombay Lahore Bangalore Tatanagar Madras Peshawar Karachi Dibrugarh

1	2	3	4	5	6		7	8	9
					(a)	(b)			
3. Electric Cables and Wires:									
(a) Bare Copper Conductors.	14,000 tons.	24,000 tons.	..	..	..	..	Subsidy to be given to the local industry to bring down electrolytic copper price to the level of that in U. K. & other foreign countries	Tatanagar Calcutta	Bombay Karachi Cawnpore Lahore Bangalore
Aluminium conductors.	3,500 tons.	—	3,500 tons.	Not known	Not known	..	.	Travancore	Katni Asansol
c) Rubber insulated cables.	250 million yards.	40 million yards.	125 million yards	180 lakhs	20 lakhs	40 lakhs	..	Tatanagar Calcutta	Bombay Karachi Cawnpore Lahore Bangalore
(d) Insulated winding wires.	350 tons.	300 tons.	1,800 tons						
4. Switchgear :									
(a) Knife-switches and fuses including iron-clad, domestic and industrial switchgear.									

(b) Manually operated disconnecting switches. (c) Simple type switchboards (d) Fabricated switchboards (e) Circuit breakers.	Rs. 4 crores	Very limited	Rs. 2 crores	4 crores	65 lakhs	60 lakhs.	...	Calcutta Bombay Bangalore Lahore	Calcutta Bombay Bangalore Lahore Tatanagar Madras Peshawar Karachi Dibrugarh
5. Insulators . .	5,000 tons	1,000 tons	5,000 tons	Not known	Not known	..	..	Calcutta Bangalore Gwalior Delhi Morvi	..
6, Electrical Measuring Instruments:	300 000 Nos.	Very limited	100,000 Nos.	25 lakhs.	15 lakhs	..	..	Poona	Bombay Nagpur Cawnpore Hyderabad (Dn.) Lahore
7. Radio sets & Equipment	400,000 Nos. High powered sets and 100,000 Nos. cheap sets	..	400,000 high powered sets and 100,000 cheap sets	2 crores	Limited	...	Duty free import of valves recommended	Bombay	Calcutta Bangalore Karachi
8. Electric lamps .	18 million lamps.	15 million lamps.	31 million lamps.	..	..	..	Duty free import of all raw materials and components to be continued.	Calcutta Bombay Karachi Mysore Patna Shikohabad	..
9. Electric fittings .	Rs. 40 lakhs	Limited	Rs. 40 lakhs	Limited.	Very small	..	..	Calcutta Bombay Lahore	Karachi Cawnpore Hyderabad (Dn.) Bangalore

1	2	3	4	5	6		7	8	9
					(a)	(b)			
10. Storage batteries.	150,000 Nos.	150,000 Nos.	200,000 Nos.	...	...	...	Existing duty to be adequately increased. Subsidy to be given to the local industry to bring down the price of raw materials to the level of that in U.K. and other foreign countries.	Calcutta Bombay Bangalore	Lahore
11. Dry batteries	500 million cells.	500 million cells.	750 million cells.	...	...	...	Same remarks as for storage batteries.	Calcutta Bombay	Lahore
12. Fans	150,000 Nos.	150,000 Nos.	200,000 Nos.	...	...	...	...	Calcutta Bombay Lahore Amritsar	...
13. Electric domestic equipment.	Rs. 40 lakhs	Little	Rs. 40 lakhs	Very limited	Very limited	...	Duty free import of nichrome wire to be permitted.	Calcutta Lahore Bombay	Calcutta Bangalore Peshawar Hyderabad (In.) Cawnpore Karachi

In regard to rest of the items, the industry being in an elementary stage of development a proper picture cannot be obtained by a statement of this type.

APPENDIX I.

General Directive to Industrial Panels

1. It is the function of panels to make recommendations to Government regarding the development of industries, both existing and new. These recommendations should be so framed as to enable Government to prepare a detailed phased plan for the five years following the cessation of hostilities, as the first stage of a 15-year plan of industrial development for the whole country.

2. In order to assist them to formulate recommendations, panels will be supplied, as far as possible, with factual information prepared by the panel secretaries. In the case of new industries, the information will consist of a general survey of the industry and the importance of starting it in India, the availability of raw material, the power requirements, the demands of the Indian markets and the probabilities of exports. In the case of existing industries, the information will naturally be more comprehensive; it will indicate, in addition, the location of existing units, the types of goods produced, the total production under each category and the assistance, if any, given by Government. These items are to be regarded as illustrative and not exhaustive.

Government will give each panel, as a basis, for discussion, the provisional target to be aimed at in the first five-year period and, wherever possible, of the target to be reached in 15 years.

3. The recommendations of the panels should cover the following points :—

(1) The scope and extent of development, including the type of products recommended.

(1-A) The estimated requirements of capital goods together with such details of those requirements as may be available in India and how much should be imported from abroad.

(2) Whether the industry should be under Government ownership either on grounds of national interest or because private capital is unlikely to take it up, and if so, whether it should be wholly or partly managed by Government.

(3) In the case of industries to be developed other than under State ownership, the capital required for such development, whether the whole of it is likely to be available by public investment and, if not, the extent to which Government assistance may be required.

(4) The extent to which technical advice from abroad may be necessary.

(4-A) The availability and the future requirements of technical personnel so as to obtain a clearer indication of the present short-comings and future needs.

(5) The manner and the degree of co-operation with foreign firms considered necessary and desirable, both as regards capital and management.

(6) The location of the industry.

(7) The nature of the assistance required from Government in the form of protective duties, bounties, research grant, expert advice, etc.

(7-A) The relative incidence of the import duty on the finished goods in comparison with the duty on the raw material from which they can be manufactured.

(8) If the industry is to be under private ownership and management, what controls, if any, should be exercised by Government.

(9) What should be the organisation of the different units of the industry, *e.g.*, should there be an industrial association? Would a cartel be desirable?

(10) The stages by which the industry should be developed.

(11) Should the industry cater for the export market?

(12) Should the industry be developed, as in Japan, on the cottage industry basis and, if so, to what extent?

4. Although, as stated above, the panels may recommend the grant of protection, it will not be their function to consider broad questions of international trade and commercial policy.

5. Joint meetings of the panels should be held, wherever necessary, to secure co-ordination particularly where the processes and the products of one industry are connected with those of another.

6. Some of the panels have been drawn broadly and it may necessary to co-opt members for dealing with specific branches of the industry. Members may be co-opted by the Chairman in consultation with the Industrial Adviser.

7. Before submitting recommendations, panels should consult Provincial Industrial Committees, particularly in the matter of location of industry. They should also, where the circumstances of the case require it, consult Industrial Committees in States or State Government/Durbar. The recommendations should be submitted to Government through the Industrial Adviser.

APPENDIX II.

List of Electrical Machinery & Equipment

A. *Heavy Electrical Stores.*

1. *Motors and Generators:—*

(a) 3-Phase slip-ring motors.
(b) Fractional horse power motors
(c) 3-Phase squirrel cage motors.
(d) Motor starters.
(e) A. C. Generators.

2. *Transformers and Condensers.*

3. *Electrical Cables and Wires.*

(a) Bare copper conductors.
(b) Aluminium conductors.
(c) Rubber insulated cables.
(d) Insulated winding wires.
(e) Other types of cables.

4. *Switchgears.*

(a) Knife switches and fuses including iron clad, domestic and industrial switchgear.
(b) Manually operated disconnecting switches.
(c) Simple type switchboards.
(d) Fabricated Switchboards.
(e) Circuit breakers.

5. *Transmission and Distribution Poles and Pole Fittings.*

6. *Insulators.*

7. *Electrical Measuring Instruments.*

(a) Ammeters.
(b) Voltmeters.
(c) Wattmeters.
(d) House service meters.
(e) Meters of other types.

8. *Signal and Interlocking Instruments.*

9. *Factory Electrical Equipment.*

(a) Electrical sirens and hooters.
(b) Soldering irons.
(c) Electric hoists and cranes.
(d) Lifting magnets.
(e) Magnetic separators.
(f) Magnetic chucks.

10. *Miscellaneous Electrical Equipment such as Furnaces and Ovens and Hospital Electrical equipment.*

11. *Electric Welding plants, Accessories and Electrodes.*

12. *Refrigerator and Air-conditioner equipment.*

B. *Light Electrical stores*

1. *Radio sets and equipment.*

(a) Receiving sets.
(b) Transmitting sets.

2. *Electric Lamps.*

(a) General service type lamps.
(b) Train, cab and auto-car lamps.
(c) Switchboard and telephone board lamps.
(d) Torch bulbs.
(e) Neon and fluorescent lamps.

3. *Electric Fittings.*

(a) Switches.
(b) Ceiling roses.
(c) Fuses.
(d) Distribution switchboards.

4. *Storage and Dry Batteries.*

5. *Electric Fans.*

(a) Ceiling-fans—A. C. and D. C.
(b) Table fans—A. C. and D. C
(c) Carriage fans.
(d) Exhaust fans—A. C. and D. C.

6. *Electric Domestic equipment.*

(a) Heaters.
(b) Kettles.
(c) Irons.
(d) Ovens.
(e) Any other type of equipment.

7. *Automobile Electrical equipment.*

8. *Telegraph and Telephone equipment.*

9. *Dairy Electrical equipment.*

10. *Electrical Sound Recording equipments.*

11. *Insulating materials.*

(a) Tapes, cloth and tubings.
(b) Fibre, leatheroid, insulating paper and presspahn paper.
(c) Varnishes.
(d) Cable jointing compounds.
(e) Mica and micanite products.
(f) Others.

APPENDIX III.

No. EM-6(1).

GOVERNMENT OF INDIA

DEPARTMENT OF PLANNING AND DEVELOPMENT,
OFFICE OF THE INDUSTRIAL ADVISER.

NEW DELHI,
Dated the , March 1946

From

The Industrial Adviser, to the Government of India,
Delhi.

To

SIRS,

SUBJECT :—*Post-War development of the Manufacture of Electrical Machinery and Equipment.*

I am directed to state that one of the Panels recently set up by the Government of India will consider the manufacture of Electrical machinery and equipment in the country.

A list of machinery and equipment with which the Panel will be concerned is enclosed (*vide* Appendix A)

In order to prepare the ground for the recommendations of the Panel, the Government of India wish to have as complete a picture as possible of the Indian manufacture of electrical machinery and equipment, as is to-day and of the position in which it is likely to find itself in the near future. For this purpose, a questionnaire has been drawn up and a copy of which is enclosed (*vide* Appendix B). It will be observed that the information asked for not only relates to facts and figures (most of which are not obtainable from existing official publications) but also invites your views as to the future development of the industry. The Government of India are anxious to secure the closest association of the industry with their post-war industrial plants and they look forward to your co-operation in the work of this industrial panel.

It is appreciated that it may not be possible for you to furnish replies on all the points in the required form. In that event, you are requested to furnish them in such a form as may suit you, although it will be very much appreciated if you can adhere as closely as possible to the form of the questionnaire. Any information furnished by you will be treated as confidential, if you so desire.

I am to request you that if possible your replies may be furnished within one month from the date of receipt of this letter. A copy of your reply may at the same time be forwarded to the Provincial Government of your Province.

Receipt of this letter may kindly be acknowledged.

I have the honour to be,

SIR,

Your most obedient servant,

for *Industrial Adviser.*

APPENDIX A.

LIST OF ELECTRICAL MACHINERY AND EQUIPMENT

1. *Motors and Generators* :—
   - (a) 3-Phase slip-ring motors.
   - (b) Fractional horse power motors.
   - (c) 3-Phase squirrel cage motors.
   - (d) Motor starters.
   - (e) A. C. Generators.
2. *Transformers and Condensers.*
3. *Cables.*
   - (a) Copper conductors.
   - (b) Aluminium conductors.
   - (c) Enamel, S. C. C., DD. C. C. and D. S. C. wires.
   - (d) Rubber insulated cables.
   - (e) Other types.
4. *Switchgears.*
   - (a) Knife switches and fuses.
   - (b) Circuit breakers.
   - (c) Disconnecting switches—manual.
   - (d) Simple type switchboards.
   - (e) Fabricated switchboards.
5. *Radio sets and equipments* :—
   - (a) Receiving sets.
   - (b) Transmitting sets.
6. *Electric Lamps* :—
   - (a) General service type.
   - (b) Train, cab and auto-car lamps.
   - (c) Switchboard lamps.
   - (d) Torch bulbs.
   - (e) Neon and fluorescent lamps.

7. *Electric Fittings:--*

(a) Switches.
(b) Ceiling roses.
(c) Fuses.
(d) Distribution switchboards.

8. *Transmission and Distribution Poles and Pole Fittings.*

9. *Storage Batteries.*

10. *Dry Batteries.*

11. *Insulators.*

12. *Electrical measuring instruments:—*

(a) Ammeters.
(b) Voltmeters.
(c) Wattmeters.
(d) House service meters.
(e) Meters of any other type.

13. *Signal and Interlocking Instruments.*

14. *Electric Fans:—*

(a) Ceiling fans
A. C.
D. C.
(b) Table fans
A. C.
D. C.
(c) Carriage fans.
(d) Exhaust fans A. C. and D. C.

15. *Electric Domestic equipment:—*

(a) Heaters.
(b) Kettles.
(c) Irons
(d) Ovens.
(e) Any other type of equipment.

16. *Electric Furnaces and Ovens.*

17. *Hospital Electrical Equipment and Apparatus.*

18. *Automobile Electrical Equipment:—*

(a) Plugs.
(b) Distributors.
(c) Condensers.
(d) Horns.
(e) Dash board equipment.
(f) Direction signs, etc.

19. *Factory Electrical Equipment.*

(a) Lifting magnets.
(b) Magnetic separators.
(c) Magnetic chucks.
(d) Soldering irons.
(e) Electric hoists and cranes.
(f) Electric sirens and hooters.

20. *Electric welding plants, Accessories and Electrodes.*

21. *Telegraph Instruments and Equipment.*

22. *Telephone Instruments and Equipment.*

23. *Dairy Electrical Equipment and Apparatus.*

24. *Telecommunications and Radar:—*

(a) Collins transmitting and receiving man pack sets.

(b) Animal pack sets.

(c) Teleprinter and auto-high speed spares.

(d) Plan position indicator items.

(e) V. H. F. Aerial assemblies.

(f) V. H. F. Receiving and transmitting sets, etc.

25. *Electrical Sound Recording Equipment.*

26. *Refrigerator and Air-Conditioner Equipment.*

27. *Insulating Material:—*

(a) Tapes, cloth and tubings.

(b) Fibre, leatheroid, insulating paper and presspahn paper.

(c) Varnishes.

(d) Cable jointing compounds.

(e) Mica and micanite products.

(f) Other types.

APPENDIX B

QUESTIONNAIRE

1. What types and sizes of Electrical Machinery and Equipment are now manufactured by your company?

2. Total production per annum in numbers and value of each of the principal products of your company—

(a) in the year 1937,

(b) during the war period (1939—1944),

(c) in any other year which the industry considers typical.

3. (a) Location of the factory.

(b) The year in which it was established.

(c) Is the industry localised in one or more regions and if so, are there any special reasons for it?

(d) Are there any particular regions where the industry could be suitably localised, taking into consideration, the proximity to markets, availability of raw materials, power, labour, etc.?

4. Raw materials required for the manufacture of different products including different kinds of steels, ferrous and non-ferrous metals and other ingredients—

(a) Quantities of each kind and type of material used per annum. Clearly indicate against each item, the country of origin and the address of the suppliers.

(b) Do you experience any difficulties in obtaining your raw materials?

(c) Are the present facilities for transportation of raw materials to your factory adequate?

5. Plant and Equipment now employed :—

(a) Give a full list of machinery installed in your factory and state the makers, name, the country of origin, the year of manufacture and cost against each machine.

If the machine was purchased second hand, an approximate estimated age of the plant may be indicated.

(b) What is the present condition of the plant?

(c) Additions and alterations to plant contemplated.

(d) Is any difficulty experienced in the upkeep and maintenance of your plant?

6. Labour conditions :—

(a) What is the strength of skilled and unskilled labour employed in your factory?

(b) What is the strength of supervisory staff employed? How many of them have received specialised training and where they have been trained?

(c) Do you need any assistance from Government for providing technical experts and advise you regarding the process of manufacture and training of your staff? If so, indicate the precise nature of assistance required.

7. Production and Sales organisation :—

(a) What is the post-war consumption of the products of your factory?

(b) How and where you market them?

(c) Do you possess your own sales organisation or you employ other firms to sell your products?

(d) Is there a reasonable constant demand in the market for your products?

(e) The scope and extent of future developments you contemplate for your industry by way of increased production or for manufacture of other types of machinery not so far manufactured.

8. Please state if, in your opinion, it is feasible to develop the manufacture of any basic component parts of your products on cottage industry lines. if so, how is such manufacture to be organised?

9. (a) What is the amount of capital of your company and how much more do you contemplate to spend on immediate and future developments? What is the capital expenditure incurred so far on land, buildings and machinery? Figures may please be shown separately against each item of expenditure.

(b) What amount of foreign capital, if any, is now invested in your company?

(c) Are your future capital requirements likely to be met by public investment in India? If not, how do you propose to meet them?

10. Do you need any protection or assistance from Government at present? If so, the same may be specified.

Are you aware of any protection given by Governments in other countries to industries such as yours? If so, please furnish details.

11. Do you desire any Government control of your industry hereafter with a view to assist its general development?

12. Do you employ any expert technical advisers from abroad and will continue to need them thereafter?

13. In case the future development of your industry depends on technical advice, patents and plants from foreign firms, how do you propose to obtain them?

14. Would you welcome forming an association of indigenous manufacturers using similar raw materials or producing similar products as your own, with a view to have a planned production and marketing?

15. Do you consider it possible for certain types of Electrical Machinery and Equipment to be built under licence with British or American firms which would enable Indian manufacturers to get expert guidance from parent concerns and produce articles to modern designs and of reliable quality?

16. Any other information for the guidance of the Panel will be appreciated.

APPENDIX IV

Statement Showing Import of Electrical Machinery and Equipment for the period 1935—1945
(Value in Thousands of Rupees.)

Item	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45
1. Motors	42,35	35,25	46,92	63,12	41,71	32,90	53,34	43,97	42,23	67,15
2. Transformers	19,00	19,66	26,23	25,63	21,93	19,12	17,84	13,44	28,31	53,64
3. Condensers	36	49	48	63	75	70	1,52	1,41	1,34	3,00
4. Cables (Bare copper wire)	10,77	14,52	10,29	17,52	14,07	9,44	13,03	6,53	5,04	2,29
5. Rubber insulated cables	29,16	31,98	42,38	47,69	42,13	37,03	19,41	23,42	24,96	61,05
6. Cables insulated other than rubber	50,95	43,57	64,79	65,95	57,12	54,14	44,44	31,88	31,74	53,63
7. Switchboards	4,14	3,10	4,73	5,11	3,20	2,08	3,55	2,53	1,72	2,75
8. Wireless apparatus	28,30	35,20	47,70	41,15	49,81	44,29	52,50	30,75	19,94	13,22
9. Lamps G. F.	19,43	16,38	19,94	14,62	12,41	8,40	11,66	12,05	11,06	21,70
10. Lamps Vacuum	16,58	12,50	15,77	9,88	10,38	9,29	10,34	5,00	2,29	4,96
11. Torch bulbs	2,84	3,23	2,88	2,48	2,59	2,52	2,06	95	1,33	2,26
12. Automobile bulbs	1,02	91	1,17	1,03	95	1,36	2,03	79	48	83
13. Electric Fittings (including switches)	8,11	6,45	7,68	6,95	7,04	6,48	8,64	4,16	2,96	4,40
14. Batteries	20,61	25,73	25,20	21,52	22,80	8,87	1,60	5,37	1,70	3,06
15. Electrical Porcelain Ware	...	...	1,33	1,35	1,40	1,17	1,46	56	48	1,78
16. Meters	10,46	11,39	11,93	12,81	14,12	10,09	20,94	8,14	3,63	4,92
17. Fans	32,51	35,16	31,07	25,10	18,64	14,27	11,66	10,53	7,69	1,93
18. Electric Medical apparatus	5,00	3,64	6,53	4,96	5,32	5,92	9,92	3,46	2,75	5,83
19. Telegraph & Telephone instruments	17,50	19,20	22,39	22,61	12,69	13,44	15,39	10,33	11,98	23,39
20. Electric Sound Recording Equipment	...	3,29	5,73	3,95	2,25	3,93	4,52	1,22	41	1,87
21. Refrigerating Machinery	14,63	15,55	28,29	13,87	21,24	17,99	20,47	2,66	6,74	5,41
22. Control & Switch Gear	44,35	48,82	54,83	90,05	59,83	49,32	62,62	61,58	55,28	77,71
23. Generators, Alternators, and Dynamos	21,59	39,78	25,90	36,97	26,30	16,36	22,49	24,68	29,44	30,59

APPENDIX V

Statement Showing Imports of Electrical Machinery and Equipment for the period 1935—45 Adjusted to 1935 Price level of the basis of Index of Prices (see copy).
(Value in Thousands of Rupees.)

Item	1935-36	1936-37	1937-38	1938-39	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45
1. Motors	42,35	28,20	35,50	45,60	37,00	26,30	38,62	29,20	26,00	38,25
2. Transformers	19,00	18,50	20,32	18,60	19,50	15,60	12,95	8,96	17,60	36,30
3. Condensers	36	46	37	48	66	56	1,10	94	82	1,71
4. Cables (Bare Copper wire)	10,77	13,69	7,96	12,69	12,50	7,55	9,50	4,35	3,10	1,31
5. Rubber insulated cables	29,16	30,10	32,70	34,50	37,40	29,60	14,10	15,60	15,30	34,80
6. Cables insulated other than rubber	50,95	41,1	50,10	47,75	50,75	43,30	32,20	21,20	19,50	30,60
7. Switchboards	4,14	2,92	3,68	3,70	2,84	1,66	2,58	1,68	1,05	1,57
8. Wireless apparatus	28,30	33,20	36,95	29,60	44,20	35,40	38,05	20,41	12,25	7,55
9. Lamps G. F.	19,43	15,40	15,50	10,60	11,01	6,71	8,46	8,04	6,80	12,40
10. Lamps Vacuum	16,58	11,80	12,20	7,15	9,22	7,41	7,54	3,33	1,41	2,83
11. Torch Bulbs	2,84	3,04	2,23	1,80	2,30	2,01	1,49	63	82	1,29
12. Automobile Bulbs	1,02	86	81	74	84	1,09	1,47	53	29	47
13. Electric Fittings (including switches)	8,11	6,09	5,94	5,02	6,25	5,18	6,28	2,78	1,82	2,50
14. Batteries	20,61	25,70	19,50	15,50	20,22	7,10	1,16	3,58	1,04	1,75
15. Electrical Porcelain Ware	...	...	1,03	98	1,24	93	1,06	37	29	1,01
16. Meters	10,46	10,72	9,24	9,28	12,56	8,08	15,20	5,42	2,23	2,80
17. Fans	32,51	33,00	24,10	18,15	16,60	11,40	8,49	7,03	4,71	1,13
18. Electric Medical apparatus	5,00	3,44	5,06	3,50	4,72	4,74	6,60	2,30	1,69	3,90
19. Telegraph and Telephone instruments	17,50	18,10	17,30	16,35	11,30	10,80	11,80	6,90	7,35	13,30
20. Electric Sound recording equipments	...	3,10	4,44	2,86	2,00	3,14	3,28	81	25	1,07
21. Refrigerating Machinery	14,33	15,00	21,90	10,00	18,90	14,38	14,87	1,77	4,14	3,18
22. Control & Switch Gear	14,35	46,00	42,50	65,30	63,00	39,40	45,60	41,10	34,00	43,30
23. Generators, Alternators & Dynamos	21,59	37,30	20,00	26,72	23,40	13,01	16,35	16,47	18,10	17,40
24. Cost index figure	1,00	1,00	1,00	1,00	1,12½	1,25	1,37½	1,50	1,62½	1,75

APPENDIX VI.

Questionnaire issued to the Office of the Electrical Commissioner with the Government of India and their Reply.

Question 1.—What is the actual or anticipated Provincewise "installed electrical power generation plant capacity in KW" in the following years :—

Year	Installed electrical power generation plant capacity in KW		
	Hydro	Steam	Oil Engine
Actual in 1939			
Anticipated in Dec. 1946 . . .			
Anticipated in Dec. 1953 . . .			
Anticipated in Dec. 1958 . . .			
Anticipated in Dec. 1963 . . .			

Reply 1.—*Actual and anticipated Provincewise installed Generating Capacities in* 1939, 1946, 1953, 1958, *and* 1963.—The installed electrical power generating capacity as at 1939 and 1946 are given provincewise in Appendix VIII under the different categories Hydro, Steam and Oil. The estimated figures for 1953 are also given. For the years 1958 and 1963 we have endeavoured to make a forecast of the approximate total generating capacity for the whole of India, but in view of the rapidly changing conditions in various provinces it is not possible to make a provincewise distribution of the total generating capacity.

The attached statement indicates that the generating capacity in Ajmer in the form of diesel engine generating sets remains stationary after 1946. This is due to the fact that Ajmer is likely to be included in the area severd by the Chambal Hydro-Electric Scheme.

Similarly no increase in the installed generating capacity in Coorg is indicated as it is anticipated that they will find it economical to obtain bulk supply either from the Madras or from the Mysore Hydro-Electric Grids. They have a Hydro-Electric Scheme under investigation but it is too early to say whether it will be implemented.

Question 2.—What is the actual or anticipated "installed electric load capacity in KW" in the following years :—

Year	Installed electric load capacity in KW				
	Lighting	Fans	Domestic load other than light, fans, motor load	Industrial load other than lights, fans and motor loads	Motor load
Actual in 1939 . .					
Anticipated in Dec. 1946					
Anticipated in Dec. 1953					
Anticipated in Dec. 1958					
Anticipated in Dec. 1963					

Reply 2.—*Statement showing connected load in various categories in the whole of India including Indian States.*—In the statement (at Appendix IX) the figures indicating the division of the connected load in the various categories is based on actual figures received from public electric utilities for the year 1946. The corresponding figures for the years 1939, 1953, 1958 and 1963 have been estimated.

Question 3.—What is the anticipated approximate cost in rupees of the electrical portion of the (a) likely projected additions to existing installed generating capacity, (b) new schemes which have either been sanctioned or are likely to be sanctioned in the near future and which are reasonably likely to be in commission by the end of 1953, and (c) for such portion of possible schemes which may be in commission by the end of 1953.

For the purpose of determining cost, the Electrical Commissioner may assume a rate as was ruling in 1939.

Reply 3.—*Cost of Electrical portion of Generating plant in Hydro-Electric, Steam and Diesel Engine driven power stations.*—In view of the wide variety of plant and large range of prices, it is only possible to make a very approximate estimate of the electrical portion of the likely extensions and new projects. In the present stage of manufacture in India, most of the plant requirements of the electric power development projects may have to be imported from outside for some time to come.

The figures given below are based on the level of prices ruling in 1945-1946 and include plant required for generating stations only. The plant and equipment required for sub-stations and receiving stations are excluded, as these cannot be estimated until the layout of the systems is decided, and many of the schemes included below are still in the stage of planning.

Type of Generating Plant	Additional capacity that is likely to be installed by end of 1953 in Meg.watts	Approximate cost of plant
		Rs.
Steam-Electric	682·543	30·7 crores
Hydro-Electric	626·317	15·7 crores
Diesel-Electric	13·060	0·46 crores

Question 4.—What is the anticipated approximate cost in rupees of that part of the electrical portion of the equipment referred to in Question 3 above which is anticipated to be of indigenous manufacture on the existing basis of production?

For the purpose of determining the cost, rates ruling in 1939 may be adopted.

Reply 4.—*Possibilities of Indigenous Manufacture of Electrical Machinery and Equipment.*—No appreciable part of the plant under reply to question 3 for the various electric power generating schemes is likely to be supplied by indigenous industries, at least for the next five years.

The estimates received by this office from the various Provincial and State Governments in respect of the power expansion schemes relate only to requirements of heavy electrical plant which comprise the following categories :—

1. Turbo-alternators of individual capacity of 1000 KW. and over.
2. Water tube boilers of individual capacity of 11,000 lbs./hr. and over.
3. Water wheel alternator sets of individual capacity of 500 KW. and over.
4. Diesel generating plant having an individual capacity of 500 KW. and over.
5. Transformers of voltages 13·2 KV and over and of lower voltages aggregating 5,000 KVA capacity and over in respect of any particular project.
6. High voltage switchgear of 13·2 KV. and over and all lower voltages aggregating 5000 KVA. capacity and over in respect of any particular project.
7. Synchronous condensers, Rotary Converters and motor-generator sets having an individual capacity of 250 KW. and over.
8. Mercury Arc Rectifiers of an individual capacity of 250 KW. and over.
9. Extra High Voltage Cables of 13·2 KV. and over.

Out of the above plant existing manufacturing capacity in India is limited to transformers upto 500 KVA and for high voltages upto 11,000 volts. and isolating switches upto 110 KV. Under the category or transformers our estimates include those having an individual capaity of 5,000 KVA or an aggregate of 5,000 KVA for schemes where similar transformers are required. The proportion of transformers under 500 KVA included in the figures given in the reply to question 3 compromises above 2 per cent. of the total value of each power station.

The data in our possession is insufficient for an estimate of the total requirement of India for transformers of 500 KVA and of smaller sizes. The Department of Industries and Supplies controlled imports of transformers of 250 KVA and of smaller sizes under the "Panel Scheme" and they could no doubt furnish estimates of the total requirements of the country of distribution transformers, in sizes which can at present be manufactured in India.

With regard to isolating switches and switchgear, only a small portion of the total requirement is at present manufactured in India.

Question 5.—Will the Electrical Commissioner to the Government of India kindly state if he has prepared or recommended to the Government of India or to any of the Provincial Governments or Indian States standards in respect of types and/or sizes of the following electrical equipment that might be required in connection with the proposed electrification of rural areas and if so kindly state the nature of such recommendation :—

(a) inside and outside wiring of rural buildings,
(b) distribution lines in rural areas, and
(c) voltage and phases of A. C. distribution in rural areas.

Reply 5.—*Standards in respect of types and sizes of wiring equipment, etc.*—The question of standardisation of an economic system of indoor and outdoor wiring for rural schemes and cheap distribution lines for rural areas, will be tackled as soon as we can do so.

With regard to the voltage of A. C. distribution in rural areas although no standards have been laid down, we have no hesitation in saying that the obvious system will be 11,000 volts A. C. 3-phase 50 cycles for High Tension distribution and 400 volts A. C. 3-phase four wire system of Low Tension distribution.

Question 6.—What is the total number of public electric supply power stations in India classified under the following heads :—

(i) generating Direct Current supply.
(ii) generating Alternating Current supply—50 cycle.
(iii) generating Alternating Current supply—25 cycle.
(iv) generating Alternating Current supply—60 cycle.
(v) generating Alternating Current supply—110 volt supply.

Reply 6.—Number of Public Electric Supply Undertaking in India classified according to systems of supply are as follows :—

Direct Current system	102
Alternating Current 50 Cy. System	298
Alternating Current 25 Cy. System	3
Alternating Current 60 Cy. System	1
Alternating Current 40 Cy. System	1
Alternating Current 110 Volts System	Nil
Total ...	405

Question 7.—In regard to the electric power stations generating Direct Current, 25 cycles and 60 cycles A. C. supply and 100 volt A.C. supply, what action, if any, has been taken, or proposed to be taken, by the Electrical Commissioner with the Government of India, to assist in the conversion of these supplies to alternating current 50 cycles, 230/440 volts.

Reply 7.—*Action taken to assist conversion of existing D. C. and A. C.* 25 *cycle,* 60 *Cycle, and* 110 *volt A. C. supply systems to standard* 50 *cycle* 400/230 *volt systems.*

The conversion of electric supply systems from non-standard to standard A.C. 50 cycles 400/230 volts must necessarily be a gradual process, for it introduces several technical and financial problems. The Office of the Electrical Commissioner is adopting the policy of advising undertakings to limit additions or extensions to non-standard generating plant to the minimum and in encouraging the utilities concerned to change over to the standard 50 cycles supply. The figures in the next paragraph will indicate that we do not anticipate any increase in the number and total capacity of installations having non-standard systems of supply.

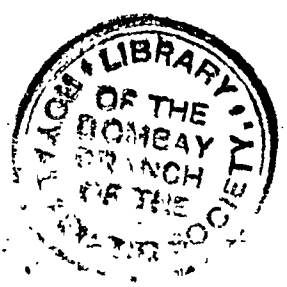
Question 8.—In regard to the anticipated installed load capacity in India by the end of 1953, what is likely to be the percentage of (a) load for Direct Current, (b) load for A. C. 25 cycles, and (c) load for A. C. 60 cycles.

Reply 8.—*Anticipated Connected load capacity by* 1953 *on various non-standard systems.*—Estimated connected load capacity in India in 1953—3,920,000 Kilos—

(a) Estimated load for D. C.—286,893 KW—7·32 % of total installed load.
(b) Estimated load for A. C. 25 cycles—62,690 KW.—1·6% of the total installed load.
(c) Estimated load for A. C. 60 cycles—5,618 KW—0·14% of the total installed load.

Question 9.—Will the Electrical Commissioner kindly give the Panel some indication and also broad outlines in general on which the electrical developments of the Provincial Governments are going on in India?

Reply 9.—*Broad outline on which electrical development in various Provinces is proceeding.*—It will be noted from a comparison of Tables 1-A, 1-B, 1-C and 1-D of Appendix VIII that there is expected to be considerable increase in the installed generating capacity in various Provinces by 1953. Wherever Hydro resources are available and these can be developed economically, the Provincial Governments are taking active steps to implement such schemes. In other cases, where such resources are lacking or their exploitation would be uneconomical, power stations are being constructed to provide power for industrialisation and for irrigation purposes by means of Nursery Power Schemes. The increase in the generating capacity indicated in the above tables would be accompanied by a corresponding increase in transmission and distribution lines and thus electrical power will be available to very much larger areas, and to a much larger percentage of the population of India than at present. The Governments of Bombay, C. P., Bengal, U. P. and Punjab and some of the Indian States are all actively planning "Nursery Power Schemes" each of which would comprise a Diesel Engine operated Power Station with a capacity of about 200/300 K.W. with a number of 11 K.V. distribution lines radiating to surrounding villages and small towns. It is expected that electrical energy would be sold at economic rates even though this might involve a small loss for the first few years. Once the masses understand the advantages of electric power and derive the benefits of larger production with less manual labour and devices employing cattle (*e.g.*, for raising water or for oil mills) the demand for electric power will increase sufficiently to enable the distribution system to be connected to a larger grid transmitting power at 66 or 132 KV and generating power either in a large steam or a hydro station.



APPENDIX VII

Analysis of Electrical Energy Generated in India in 1939 (Public Utilities only.)

Kilowatt hours generated in millions

—	Steam	Diesel	Hydro	Total	kwh. generated per capita (approx)	kwh. generated per sq. mile (approx)
Ajmer-Merwara	...	1·729	...	1·729	2·96	720
Assam	...	1 615	1·009	2·624	0·26	48
Baluchistan	...	1·685	...	1·685	3·36	31
Bengal	546·859	5·550	1·568	553·977	9·19	7153
Bihar	47·248	4·976	...	52·224	1·44	749
Bombay	120·282	18·868	696·668	835·818	40·09	10934
C. P.	11·875	3·927	...	15·802	0·94	160
Coorg	...	...	...	...	...	...
Delhi	32·841	2·878	...	35·719	38·91	62228
Madras	65·928	11·199	147·700	224·827	4·58	1782
N. W. F. P.	2·025	0·831	5·409	8·265	2·72	579
Orissa	...	1·027	...	1·027	0·12	32
Punjab	39·184	10·710	79·559	129·453	4·56	1806
Sind	0·443	29·633	...	30·076	6·63	625
U. P.	155·305	3·054	98·493	256·852	4·67	2417
Total	1,021·990	97·682	1030·406	2,150·078	7·27	2484
STATES						
Baroda	...	6·304	...	6·304	2·21	771
Bikaner	9 802	...	...	9·802	7·58	423
Hyderabad	19·513	2·134	...	21·647	1·33	263
Kashmir	...	0·066	18·837	18·903	4·79	270
Mysore	...	...	259·056	259·056	35·35	8794
Rampur	2·424	...	...	2·424	5·08	2711
Travancore	...	1·703	4·198	5·901	0·97	770
Other States	26·031	32·160	0·621	58·812	1·07	119
Total	57·770	42·367	282·712	382·849	4·12	535
Total for All India.	1,079·049	140·049	1313·118	2,532·927	6·5	1602

APPENDIX VIII

Installed Capacity of Electrical Power Generating Plants in Public Electric Utilities in 1939.—Provincewise tabulation

TABLE 1-A.

Province	Steam	Hydro	Diesel/Gas	Total	Remarks
Ajmer . . .	...	...	1,394	1,394	
Assam . . .	...	500	1,506	2,006	
Baluchistan . .	...	...	1,250	1,250	
Bengal . . .	267,907	1,400	3,598	272,905	
Bihar . . .	21,600	...	3,418	25,018	
Bombay . . .	67,407	232,114	15,918	315,439	
C. P. . . .	10,139	...	3,616	13,755	
Coorg	...	...	...	...	Started in 1942
Delhi . . .	10,900	...	4,386	15,286	
Madras . . .	47,150	69,650	7,282	124,082	
N. W. F. P. . .	2,300	9,600	9,880	12,880	
Orissa . . .	...	...	856	856	
Punjab . . .	26,478	49,750	13,309	89,537	
Sind . . .	275	...	13,635	13,910	
U. P. . . .	89,773	22,700	8,120	120,393	
Mysore . . .	...	45,000	...	45,000	
Travancore . .	...	15,400	1,443	16,843	
Hyderabad . .	9,750	...	3,151	12,901	
Kashmir . . .	...	4,315	265	4,580	
Other States . .	19,584	340	28,116	43,040	
Total .	573,063	450,769	112,243	1,136,075	

Installed capacity of Electrical Power Generating Plant in KW in Public Electric Utilities in 1946—Provincewise tabulation

TABLE 1-B

Province	Steam	Hydro	Diesel	Total
Ajmer	...	...	1,394	1,394
Assam	320	500	2,204	3,024
Baluchistan	...	...	1,250	1,250
Bengal	349,051	2,760	4,411	356,222
Bihar	27,200	...	3,962	31,162
Bombay	82,407	232,114	17,064	331,585
C. P.	23,639	...	3,988	27,627
Coorg	...	...	74	74
Delhi	24,900	...	6,385	31,285
Madras	55,650	97,050	5,840	158,540
N. W. F. P.	...	9,600	1,030	10,630
Orissa	...	...	1,221	1,221
Punjab	26,476	49,750	13,613	89,839
Sind	6,025	...	15,689	21,714
U. P.	138,245	22,700	8,430	169,375
Mysore	...	73,000	...	73,000
Travancore	...	15,400	1,547	16,947
Hyderabad	16,750	...	3,151	19,901
Kashmir	1,500	4,005	265	5,770
Other States	23,023	340	30,007	53,370
Total	775,186	507,219	121,525	1403,930

Estimated Figures of Installed Genrating Capacity in Public Electric Utilities in 1953

TABLE No. 1-C

Province	Steam	Hydro	Diesel	Total
Ajmer	...	...	1,394	1,394
Assam	427	667	2,939	4,033
Baluchistan	...	...	1,667	1,667
Bengal	723,051	7,760	4,411	735,222
Bihar	114,700	44,000	4,358	163,058
Bombay	132,407	336,114	19,494	488,015

Province.	Steam	Hydro	Diesel	Total
C. P. . . .	43,639	...	4,500	48,139
Coorg . . .	...	...	74	74
Delhi . . .	44,900	...	6,385	51,285
Madras . .	79,650	223,600	5,840	309,090
N. W. F. P. .	...	14,600	1,030	15,630
Orissa . .	2,000	...	2,000	4,000
Punjab . .	28,976	99,750	14,974	143,700
Sind . . .	18,025	8,400	16,689	43 114
U. P. . . .	171,245	127,100	9,000	307,345
Mysore . .	...	181,000	...	181,000
Travancore . .	...	37,900	1,547	39,447
Hyderabad . .	54,250	10,000	3,151	67,401
Kashmir . .	1,500	10,005	265	10,270
Other States .	42,773	32,640	34,867	111,780
Total .	1,457,543	1,133,536	134,585	2,725,664
Total—1958 .	1,675,000	1,470,000	141,200	3,286,200
Total—1963 .	1,890,000	1 810,000	148,000	3,848,000

Summary of total installed capacities of Generating Plant in Public Electric Utilities for the whole of India including Indian States between 1939 and 1963

TABLE No. 1-D

All figures in Megawatts

Type of Plant	1939	1946	1953	1958	1963
A) Steam Electric .	573·063	775·186	1,457·543	1,675·000	1,890·000
Percentage increase on 1939 figures.	...	35%	154	192	230
(B) Hydro Electric .	450·769	507·219	1,133·536	1,470·000	1,810·000
Percentage increase on 1939 figures.	...	12%	147	226	300
(C) Diesel Electric .	112·243	121·525	134·585	141·200	148·000
Percentage increase on 1939 figures.	...	7%	20	26	32
(D) Total . .	1,136·075	1,403·930	2,725·664	3,286·200	3,848·000
Percentage increase on 1939 figures.	...	24%	145	194	245

APPENDIX IX

Statement showing connected load in various categories in the whole of India including Indian States in 1939 and 1946 and approximate estimate of connected loads in 1953, 1958 and 1963.

Year	Installed Electric Load Capacity		Remarks
	Domestic Load KW (a)	Industrial load KW (b)	
	Rs.		
1939	635,200	905,600	Approximate estimated loads under:—
46	780,905	1,109,620	(a) Lighting . 19%
1953	1,362,200	2,077,000	Fan . . 73%
1958	1,756,000	2,497,000	Heating & others. 8%
1963	2,054,000	2,916,000	(b) Motor . 91%
			Heating, Welding, etc. 9%

APPENDIX X

Statement showing proposed allocation of Spindleage to various Provinces and States in India.

Zone	Provinces and States	Fine Spindles	Coarse Spindles
Bombay Surplus Area .	Bombay Presidency .	114,000	...
	Baroda	38,000	...
	Nawanagar . . .	...	25,000
	Junagadh . . .	...	25,000
	Bhavnagar . . .	...	25,000
	Cambay	19,000	...
Sind Zone . . .	Sind Province . .	...	75,000
	Khairpur . . .	...	25,000
Punjab Zone . . .	Punjab Province . .	114,000	323,000
	Delhi Province . .	...	...
	N. W. F. P. . . .	...	...

Zone	Provinces and States	Fine Spindle	Coarse Spindles
	Bahawalpur . . .	...	50,000
	Nabha	....	25,000
	Kapurthala . . .	...	25,000
United Provinces Zone .	United Provinces . . .	114,000	150,000
	Benares State . . .	...	25,000
Bihar Zone . . .	Bihar Province . .	38,000	175,000
Bengal Zone . . .	Bengal Presidency . .	125,000	200,000
	Assam Province . .	100,000	(Coarse and fine mixed).
	Seraikala . . .	...	25,000
Orissa Zone . . .	Orissa Province . .	19,000	100,000
	Mayurbhunj . . .	...	25,000
Central Provinces Zone .	Central Provinces . .	76,000	75,000
	Rewa	...	25,000
South Zone . . .	Madras Presidency . .	152,000	200,000
	Hyderabad . .	19,000	50,000
	Mysore	19,000	25,000
	Travancore . . .	...	50,000
	Cochin	...	25,000
	Pudukottah . . .	...	25,000
Rajputana Zone . .	Gwalior	19,000	...
	Bharatpur . . .	...	25,000
	Bikaner	...	25,000
	Dholpur	...	25,000
	Alwar	...	25,000
	Palanpur . . .	19,000	...
Total		885,000	fine spindles.
		1,873,000	coarse spindles.
		100,000	for Assam, coarse and fine together.
		2,858,000	

APPENDIX XI.

List of Electrical Machinery required by Textile Mills

Machinery required per mill of 10,000 Fine Counts Spindles.

Blow Room Machinery—

	H.P
1 Hopper Bale Opener	2
1 Roving Waste Opener	3
1 Auto hopper Opener	1
1 Porcupine Opener	2
1 Inter or breaker Scutcher	4
1 Horizontal exhaust Opener & Scutcher	9
1 Finishing Scutcher (16 oz. Lap)	8
Individual Drive	30
Group Drive	45

Spinning Machinery—

	H.P.
22 Carding Engines, 1 H.P. each	22
1 Silver Lap machine, ½ H.P. each	½
1 Ribbon Lap machine, 1 H.P. each	1
8 Combing Machines, ¾ H.P. each	6
3 Drawing Frames of 2 Heads of 5 Deliveries 1 H.P. each	3
1 Slubbing Frame (100 Spindles), 2¾ H.P. each	2½
2 Intermediate Frames (142 Spindles), 2¾ H.P. each	5½
6 Roving Frames (180 spindles) 2¾ H.P. each	16½
10,500 Ring Spindles, *i.e.*, 26 Ring Frames, 7½ H.P. each	195
Individual Drive	252½
Group Drive	290

Weaving Preparatory Machines—

	H.P.
10 Vertical spindle winder, ¾ H.P. each	7½
9 Universal Weft Winder, 1 H.P. each	9
6 Warper (Bean Winder) 1 H.P. each	6
4 Sizing Machines, 2 H.P. each	8
60 Reeling Frames, ¼ H.P. each	15
Individual Drive	45
Group Drive	55

Weaving Shed—

	H.P.
233 Looms, ¾ H.P. each	175
Individual Drive	175
Group Drive	215

Bleaching Machinery—

	H.P
1 Four Burner Singeing Machinery	5
1 Shearing Machine	8
2 Vertical High Pressure Gears 15 H.P. each	30
2 Washing Machines, 10 H.P. each	20
2 Chemicking Machines, 10 H.P. each	30
1 Squeezing Machine 12 H.P. each	12
Individual Drive	95
Group Drive	119

Dyeing Machinery—

	H.P.
4 Jiggers, 1½ H.P. each	9
2 Three Bowl Padding Machinery, 15 H.P. each	30
1 Padding Machine, with Hot Air Drying Range	25
1 Developing Range	12
1 Package Dyeing Machine.	15
1 Cheese and Beam Dyeing Machine	12
Individual Drive	100
Group Drive	125

Printing and Finishing Machinery—

	H P
1 Brushing and Bleaching Machinery, 12 H.P. each	12
4 Colour Mixing Pans, 5 H.P.	5
1 Three Colour Printing Machines with Drying Range	25
1 Rapid Ager	5
1 Aneline Ager	5
1 Developing Range	5
1 Two Bowl Mangle with Drying Range 29 Cylinder Horizontal	12
Drying Machine	9
1 29 Cylinder Horizontal Drying Machine with water mangle	15
1 90 Stentor with Jigging device	25
1 Fan for the stentor	25
1 Cloth Mercerising Machine	40
1 Yarn Mercerising Machine	40
1 Five Bowl Universal Calender	50
1 Three Bowl Universal Calender	30
1 Schreiner Calender	16
1 40 Stentor Open Type with Weft Straightener	20
1 Fan for the Stentor	25
Individual Drive	364
Group Drive	400

Folding Machinery—

	H.P.
10 Folding Machineries, 1 H.P. each	10
4 Stamping Machines, ½ H.P. each	2
2 Baling Press, 20 H.P. each	40
Individual Drive	52
Group Drive	68

Electrolyser Plant

	H.P.
1 Electrolyser Motor Generator, Set for 40 Cells	150
1 Electrolyser Motor Pump	1½
1 Electrolyser Motor Chloride Pump	2½
Individual Drive	154

Summary of Power Required

	H.P.
Blow Room	45
Spinning	290
Weaving Preparatory	55
Weaving Shed	215
Bleaching	110
Dyeing	125
Printing and Finishing	400
Folding	68
Electrolyser Plant	154
	1,462
Auxiliaries and Humidification	200
	1,662-1,246 K.W.

SECTION A.

Motors for Individual Drive

Motors	H.P. each
60	¼
3	½
183	¾
51	1
6	1½
4	2
2	2½
8	2¾
1	3½
1	4
5	5
26	7½
2	8
2	9
4	10
4	12
2	15
3	20
1	30
2	40
1	50
1 Motor Generator	180

SECTION B.

Motor for Group Drive

Motor	H.P. each
1	1½
1	2½
6	5
1	8
1	9
4	10
5	12
7	15
4	20
32	25
1	30
2	40
1	50
1 Motor Generator	150

SECTION C.

Total Motors required for Individual Drive

(For distribution of 935,000 Ring Spindles, Fine Counts)

Motors		H.P. each
5,580		½
279		⅝
17,019		¾
4,743		1
558		1½
372		2
186		2½
744		2¾
93		3½
93		4
465		5
2,418	(Variable speed)	7½
186		8
186		9
372		10
372		12
744		15
279		20
93		30
186		40
93		50
Total 34,061	Motors	
93	Motors Generator	150

SECTION D.

Total Motors required for Group Drive

(For distribution of 935,000 Ring Spindles, Fine Counts).

Motors		H.P. each
93		1½
93		2½
558		5
93		8
93		9
372		10
465		12
744		15
372		20
2,976		25
93		30
186		40
93		50
Total 6,231	Motors	
93	Motor Generator	150

MACHINERY REQUIRED PER MILL OF 4,000 COARSE COUNTS SPINDLES.

Blow Room Machinery—

	H.P.
1 Hopper Ball Opener	2
2 Roving-Waste Opener	3½
1 Auto Silver Fitter	1½
1 Porcupine Opener	2
1 Vertical or Creighton Opener	8
1 Vertical with single Scutcher	4
1 Inter Air Breaker Scutcher	8
1 Finishing Scutcher (10 oz. Lap)	4
Individual Drive	33
Group Drive	42

Spinning Machinery—

15 Carding Engines, 1 H. P. each	15
3 Drawing Frames of 2 Heads of 5 Deliveries each, 1 H. P. each	3
1 Sloving Frame, 100 Spindles, 2½ H. P. each	2½
2 Intermediate Frames, 142 Spindles, 2·½ H. P. each	5½
3 Roving Frames, 180 Spindles each 2·¾ H. P. each	8¼
4,000 Ring Spindles, *i.e.*, 10 Ring Frames, 400 Spindles each, 7·5 H. P. each	75
Individual Drive	109¼
Group Drive	124

Weaving Preparatory Machines—

6 Vertical Spindle Winders, ¾ H. P. each	4½
5 Universal Weft Winders, 1 H. P. each	5
4 Warper Beam Winder, 1 H. P. each	4
2 Sizing Machines, 2 H. P. each	4
30 Reeling Frames, ¼ H. P. each	7½
Individual Drive	25
Group Drive	32

Weaving Shed.—

	H. P.
125 Looms, ¾ H.P.	94
Individual Drive	94
Group Drive	126

Bleaching Machinery.—

	H. P.
1 Four Burner Singeing Machinery	5
1 Shearing Machine	8
2 Vertical High Pressure Gears 15 H. P. each	30
2 Washing Machines, 10 H. P. each	20
2 Chemicking Machines, 10 H. P. each	20
1 Squeezing Machine, 12 H. P. each	12
Individual Drive	95
Group Drive	110

Dyeing Machinery .—

	H. P.
4 Jiggers, 1½ H. P.	6
2 Three Bowl Padding Machinery, 15 H. P. each	30
1 Padding Machine, with Hot Air Drying Range	25
1 Developing Range	12
1 Package Dyeing Machine	15
1 Cheese & Beam Dyeing Machine	12
Individual Drive	100
Group Drive	125

Printing & Finishing Machinery.—

	H. P.
1 Brushing & Bleaching Machinery, 12 H. P. each	12
4 Colour Mixing Pans	5
1-3 Colour Printing Machines with Drying Range	25
1 Rapid Ager	5
1 Aneline Ager	5
1 Developing Range	5
1 Two Bowl Mangle with Drying Range	12
1-29 Cylinder Horizontal Drying Machine	9
1-29 Cylinder Horizontal Drying Machine with water Mangle.	15
1-90" Stentor with Jigging Devided	25
1 Fan for the Stentor	25
1-40" Open Type Stentor with Weft Straightener	20
1 Fan for the Stentor	25
1 Cloth Mercerising Machine	40
1 Yarn Bowl Universal Calender.	50
1 Three Bowl Universal Calender	30
1 Schreiner Calender	16
Individual Drive	364
Group Drive	400

Folding Machinery.—

	H. P.
5 Folding Machineries 1 H. P. each	5
2 Stamping Machines, ½ H. P. each	1
1 Baling Press	20
Individual Drive	26
Group Drive	34

Electrolyser Plant—

	HP.
1 Electrolyser Motor Generator for 24 Cells	75
1 Electrolyser Motor Pump	1½
1 Electrolyser Chloride Pump	2½
Individual Drive	79
Group Drive.	..

Summary of power Required—

	H. P
Blow Room	42
Spinning	124
Weaving Preparatory	32
Weaving Shed	126
Bleaching	110
Dyeing	125
Printing & Finishing	400
Folding	34
Electrolyser	79
	1,072
Auxiliaries and Humidification	200
	1,272
=	954 K.W

SECTION A.

Motors required for Individual Drive

Motors	H. P. each
30	1½
2	1½
131	¾
32	1
6	1½
4	2
2	2½
5	2¾
1	3
1	3½
2	4
10	7½
3	8
1	9
4	10
5	12
5	15
1	20
5	25
2	30
2	40
1	50
1	75

SECTION B.

Motors Required for Group Drive.

Motor	H. P. each.
1	1½
2	2½
3	5
4	10
5	12
5	15
3	20
15	25
3	30
2	40
1	50
1	75

SECTION C.

Total Motors Required for Individual Drive

(For distribution of 1,923,000 Ring Spindles Course Counts)

Motors	H. P. each
14,400	½
960	⅝
32,880	¾
15,360	1
2,880	1½
1,920	2
960	2½
2,400	2¾
480	3
480	3½
960	4
4,800	7½
1,440	8
480	9
1,320	10
2,400	12
2,400	15
480	20
2,400	25
960	30
960	40
480	50
TOTAL 122,400	

480 Motor Generators 75 H. P. each.

SECTION D.

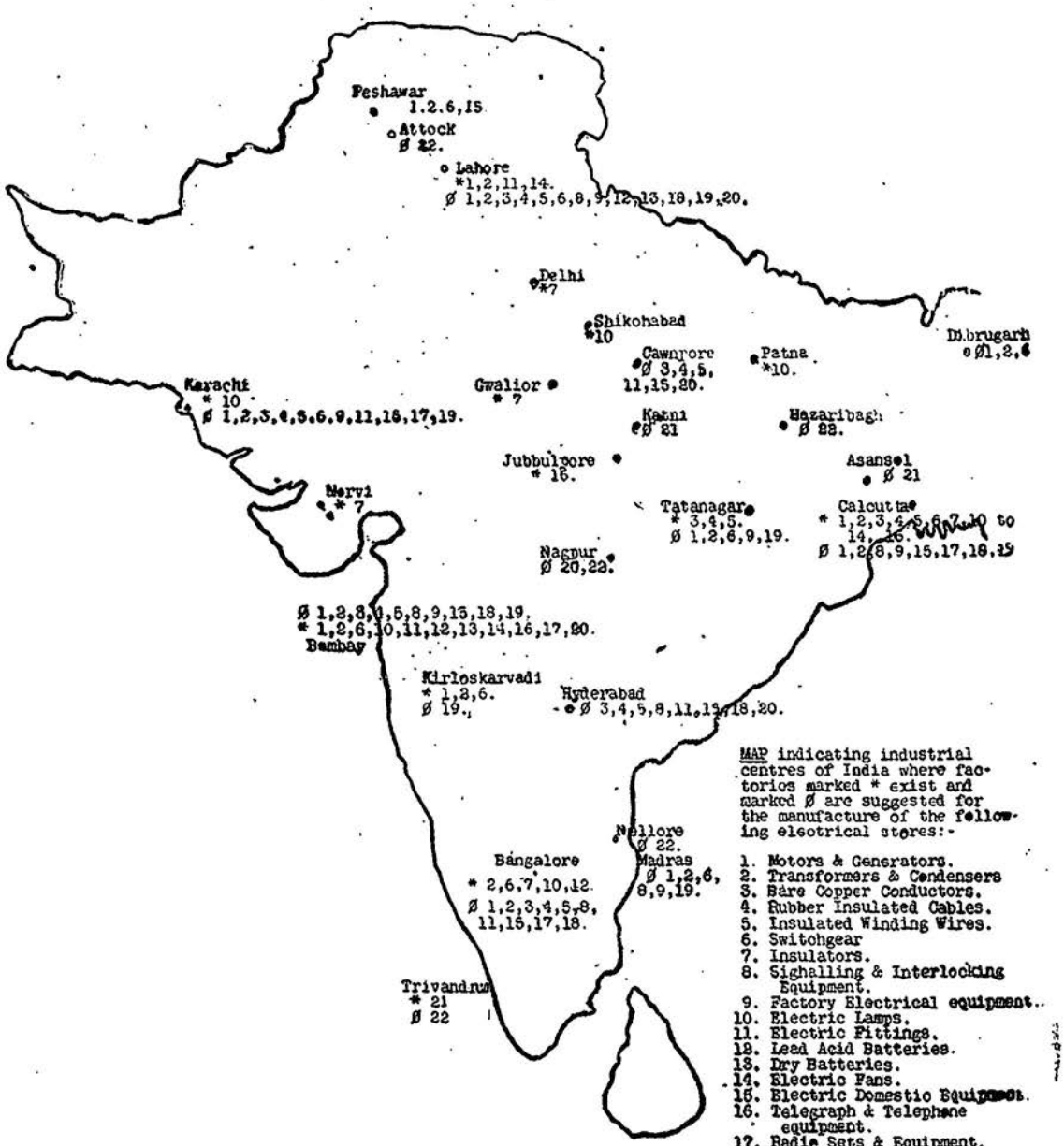
Total Motors required for Group Drive

(For distribution of 1,923,000 Ring Spindles, Course Counts)

Motors	H. P. each
480	1½
960	2½
1,440	5
1,920	10
2,400	12
2,400	15
1,440	20
7,200	25
1,440	30
960	40
480	50
21,220	

480 Motor Generators 75 H. P. each.

APPENDIX XII



MAP indicating industrial centres of India where factories marked * exist and marked Ø are suggested for the manufacture of the following electrical stores:-

1. Motors & Generators.
2. Transformers & Condensers
3. Bare Copper Conductors.
4. Rubber Insulated Cables.
5. Insulated Winding Wires.
6. Switchgear
7. Insulators.
8. Sighalling & Interlocking Equipment.
9. Factory Electrical equipment.
10. Electric Lamps.
11. Electric Fittings.
12. Lead Acid Batteries.
13. Dry Batteries.
14. Electric Fans.
15. Electric Domestic Equipment.
16. Telegraph & Telephone equipment.
17. Radio Sets & Equipment.
18. Refrigerator & Air-conditioner equipment.
19. Electric Welding Plants, Accessories & Electrodes.
20. Electrical Measuring Instruments.
21. Aluminium Conductors.
22. Insulating Materials.

NOTE Factories having less than an annual output of Rs.2½ lakhs value are not shown.

GIPD.--L—50 I&SD—12.10.47—1650

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GOVERNMENT OF INDIA

Planning & Development Department

(OFFICE OF THE INDUSTRIAL ADVISER)

Report of Heavy Chemicals and Electro-Chemical Industries Panels

Cx-0.21.

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HEAVY CHEMICALS

Importance of Heavy Chemical Industries.—The absolute dependence of a country on a sound Heavy Chemical Industry for success whether in war or peace has been so thoroughly demonstrated since the 1st World War, that it is superfluous to argue for the establishment and development of such an industry in this country. Great strides have been made in India in a number of industries, such as iron and steel, textiles, sugar, cement and jute during the last war, but the advance in chemical industries has been much less, as can be seen from a comparison of the capital invested in those industries and in Heavy Chemicals respectively (Appendix I). We are, therefore, of the opinion that in any future planning which aims at the industrial advancement of India, the establishment of a sound Heavy Chemical Industry is essential.

Heavy Chemicals.

2. The term "Heavy Chemicals" is generally understood to refer to those chemicals that are produced in large quantities—usually at low cost, and serve as raw materials or treating agents for other process industries. The importance of heavy chemicals, therefore, lies in the fact of their being essential for other industries like textiles, soap, rayon, fertilisers, glass, leather, paper, etc., and their consumption depends on the activity of those industries. Consequently, while the price of basic chemicals will undoubtedly influence the development of other industries, there must be an all-round development of consumer industries to enable a sound Heavy Chemical Industry to be established. The main Heavy Chemicals are, as generally understood, sulphuric and other mineral acids and related compounds, soda ash, caustic soda and fertilisers; but taking into account the new chemicals that have come into industrial use during recent years, as a result of newly developed processes, the list would include a much larger number. A comprehensive list of Heavy Chemicals is given in Appendix II. Consumption of Heavy Chemicals per head of population is an index of the industrial development of a country and India's very unfavourable position can be readily seen from the following figures in respect of the three important Heavy Chemicals,—sulphuric acid, soda ash and caustic soda.

TABLE I.

Annual consumption per head of poplulation.

——	Sulphuric acid.	Soda ash.	Caustic soda.
India	0·33 lb	0·6 lb	0·30 lb
U. K.	44·8 lb		
U. S. A.	113·0 lb	56·0 lb	19·4 lb

I. SULPHUR AND ITS COMPOUNDS

(a) Sulphuric Acid.

3. There is scarcely an important industry which is not directly or indirectly dependent to some extent on sulphuric acid, one of its salts or derivatives. The manufacture of the acid involves by far the greatest consumption of elemental and combined sulphur. From an

analysis of the main lines of consumption in the U.S.A. and in India (Table II), it is seen that some of the industries which consume sulphuric acid in large quantities in other countries have not been developed in India to any appreciable extent. In considering the future expansion of the industry, we have therefore been guided by the possibility of establishing new consumer lines or expanding those already existing.

TABLE II.

—	U.S.A. (1940 Qty. (tons).	%age.	India (1944). Qty. (tons).	%age.
Fertilisers	1,406,000	24·7	20,000	35·9
Petroleum refining ...	790,000	13·9	1,611	2·9
Chemicals	677,900	11·9	21,000	37·7
Coal products	559,800	9·8		
Iron and steel	746,400	13·1	3,995	7·1
Other metallurgical ...	398,100	7·0		
Paints and pigments	354,600	6·2		
Explosives	108,800	1·9		
Rayon and cellulose film ...	292,300	5·2		
Textiles	77,750	1·4	3,286	5·9
Miscellaneous	279,900	4·9	5,868	10·5
	5,691,550	100·0	55,760	100·0

(Figures relating to the U S.A. are from Rogers' Industrial Chemistry).

4. From an analysis of consumption of sulphuric acid in India (Table III), it is seen that although chemicals and fertilisers take up the largest proportion of the acid produced, the quantities consumed are very small as compared with those used for these purposes in other countries. The figures for fertilisers are particularly significant, bearing in mind the area and population of India.

TABLE III.

Analysis of consumption of sulphuric acid in India (in tons).

—	Present consumption		Five-year target.
	Percentage.	Qty.	
1. Chemicals	37·7	21,000	35,000
2. Fertilisers	35·9	20,000	63,000
3. Metals	7·1	3,995	7,000
4. Cotton Textile	5·9	3,286	5,100
5. C.C.P. (S)	4·0	2,236	1,000
6. Mineral Oil	2·9	1,611	2,000
7. Leather	1·4	790	1,000
8. Battery acid	0·7	410	1,000
9. Distillery	0·6	318	1,000
10. Miscellaneous	3·8	2,114	2,500
11. Rayon Industry ...	...	...	34,000
	..	55.760	152,600

5. We are aware that many industries formerly using sulphuric acid are now becoming independent of this chemical in other countries, typical cases being those of ammonium sulphate, hydrochloric acid, nitric acid and superphosphate. Ammonium sulphate is now made at some places from gypsum, hydrochloric acid directly from hydrogen and chlorine, and nitric acid from atmospheric nitrogen. Although enormous quantities of superphosphate are still made by the use of sulphuric acid, there are indications that it may also be made sooner or later by the use of electrical energy, eliminating the use of the acid altogether. In the U.S.A., this process has already been developed and plants have been erected and are working in the Tennesse Valley; but it may take some time before we are able to develop this technically difficult process in India. We understand, however, that one firm in South India is considering the installation of a plant.

6. On the other hand, the use of chemicals like sulphate of alumina, alum, copper sulphate and Epsom salt would increase in the post-war period. Superphosphate production will, at least for some time to come, consume a large quantity of the acid. Expansion in the textile, metallurgical and paint industries would take up more acid. Rayon and dyestuff industries when started would be large consumers. All these factors have to be taken into account in considering the question of establishing this industry on a sound footing.

TABLE IV

Year.	Production.	Capacity.
	Tons.	Tons.
1937-38	26,755	57,000
1938-39	25,585	57,000
1939-40	30,730	57,000
1940-41	...	...
1941-42	42,909	57,000
1942-43	40,646	57,000
1943-44	59,000	57,000
1944	59,000	About 65,000*
1946	...	About 77,000

7. From the figures of production of sulphuric acid in India as also those of capacity during a number of years (Table IV), it is seen that including the four new contact plants which have been recently erected, the total production capacity is 77,000 tons per annum. One unsatisfactory feature of the sulphuric acid industry in India in the past has been that although capacity was as high as 57,000 tons, actual production was only about 26,000 tons, because the high price of the acid

*Capacity is probably more, if all the small plants installed during War are taken into account.

prevented the consumer industries from thriving on account of foreign competition. On account of the high freight and insurance charges, the acid itself could not ordinarily be imported and marketed in India at competitive prices, but its salts and other solid products derived from it enjoyed favourable sea freight rates and having been manufactured from cheap acid in other countries, competition was intense in these. The result was that Indian factories could work only for short periods and the cost of production became still higher on that account. Therefore, in any expansion planned, we consider that capacity should be increased cautiously and new plants allowed to be installed only after a profitable outlet for the acid is assured.

8. Whatever may be the development of new processes involving the elimination of the use of sulphuric acid, it may be stated with a fair amount of certainty that the low cost of the acid made under favourable conditions tends to prevent any sudden or radical change in the economic status of this important chemical. It is true that India's present capacity is sufficient for her immediate needs. New plants are also likely to be installed by some firms. On the other hand, developments should be expected along new lines. About 410,000 tons of ammonium sulphate are proposed to be manufactured in Sindhri, Alwaye and Belagula; corresponding to this, at least 100,000 tons of superphosphates would be necessary. Although there is difference of opinion some agricultural experts as to the utility of superphosphates in certain parts of India, we consider that the five-year target for superphosphates should be 100,000 tons per year. Provision for the acid required for this quantity of superphosphate has been made under "Fertilisers" in Table III.

Rayon Industry will also require large quantities of acid. We understand that the Rayon Panel has fixed a five-year-target of 60 tons of viscose rayon per day. This will require about 99 tons of 60°. Be sulphuric acid equivalent to 77 tons of 100% acid per day or about 28,105 tons per year. Auxiliary chemicals for the rayon industry would require about 6,000 tons of acid per year, making up a total of about 34,000 tons for this industry. Sulphuric acid will also be required for the manufacture of ammonium sulphate from ammonia obtained during the distillation of coal. We anticipate that there will be increased distillation of coal here-after, since larger quantities of coke for metallurgical purposes and of organic chemicals for the dyestuffs industry will be required. Provision for the extra acid required has been made under "Fertilisers" in Table III. The acid will also be required in the electrolytic alkali plants for drying chlorine, but it is not used up and can be utilised for the manufacture of salts. Taking into account the expansion visualised in the different acid-consuming industries detailed in Table III, we consider that the five-year-target for sulphuric acid should be 152,600 tons per year. It is estimated that the Dyestuffs Industry may require about 20,000 tons of acid of different strengths, which is not included in the above target.

9. We understand that the Government of India have granted import licenses for one 35-ton-per-day plant for the manufacture of acid from gypsum to be erected in Madras Presidency and one 10-ton-per-day contact plant for Bihar. We also understand that the Travancore Fertilisers & Chemicals propose to instal a 75-ton-per-day plant for their ammonium sulphate manufacture. The Travancore firm, would however, consume most of the acid in their own works, only about 3,000

INTRODUCTORY

The Heavy Chemicals and the Electro-chemical Industries Panels were constituted by the Planning and Development Department (Government of India) in their letters No. P-1(11)/44 and P-1(21)/44 dated the 8th March 1945 respectively, the members being as follows:—

H. C. Panel		E C. Panel.
Chairman	Sir Shri Ram	*Chairman* Sir J. C. Ghosh.
Members	Mr. Kapilram Vakil.	*Members* Dr. B. K. Ram Prasad.
	Dr. M. S. Patel.	Mr. Kenneth Hall.
	Mr. V. Seshasayee.	Dr. M. S Patel.
	Mr. S. G. Sastry.	Mr. Kapilram Vakil.
	Mr. P. R. Crerar.	Mr. T. Parker.

2. The General Directive to Industrial Panels called for recommendations of the Panels on the following points:—

3(1) The scope and extent of development, including the type of products recommended.

(1-A) The estimated requirements of capital goods together with such details of those requirements as may be available in India and how much should be imported from abroad.

(2) Whether the industry should be under Government ownership either on grounds of national interest or because private capital is unlikely to take it up, and if so, whether it should be wholly or partly managed by Government.

(3) In the case of industries to be developed other than under State ownership, the capital required for such development, whether the whole of it is likely to be available by public investment and, if not, the extent to which Government assistance may be required.

(4) The extent to which technical advice from abroad may be necessary.

(4-A) The availability and the future requirements of technical personnel so as to obtain a clearer indication of the present short-comings and future needs.

(5) The manner and the degree of co-operation with foreign firms considered necessary and desirable, both as regards capital and management.

(6) The location of the industry.

(7) The nature of the assistance required from Government in the form of protective duties, bounties, research grant, expert advice, etc.

(7-A) The relative incidence of the import duty on the finished goods in comparison with the duty on the raw materials from which they can be manufactured.

(8) If the industry is to be under private ownership and management, what controls, if any, should be exercised by Government.

(9) What should be the organisation of the different units of the industry, e.g., should there be an industrial association? Would a cartel be desirable?

(10) The stages by which the industry should be developed.

(11) Should the industry cater for the export market?

(12) Should the industry be developed, as in Japan, on the cottage industry basis and if so, to what extent?

3. Since many of the subjects to be dealt with by the two Panels were common, the Chairmen and the members of these Panels agreed to have joint meetings and discuss all the subjects together. This was found to be more satisfactory for expeditious work and unnecessary duplication of work was thus avoided. We have also submitted only one report, Part I dealing with Heavy Chemicals and Part II with Electro-chemical Industries. Four meetings in all including the meeting with the Provincial Government and State representatives were held. The Electro-chemical Industries Panel also held a joint meeting with the Non-ferrous Metals Panel at which subjects of common interest, such as copper, zinc, aluminium, magnesium and ferro-alloys were discussed.

4. Mr. Kapilram Vakil who was a member of both the Panels attended only the first meeting. He passed away on the 29th January 1946 and the Panels were deprived of the benefit of his valuable views on the different chemical industries, of which he was a pioneer in India.

Two members, Messrs. P. R. Crerar and T. Parker resigned before the completion of the work of the Panels, as they relinquished their appointments and left India. Mr. Crerar attended one meeting and Mr. Parker, two and they were in agreement with the views expressed in the report, although their signatures do not appear herein.

5. At the meeting of the Panels with the Provincial and State, representatives on the 31st May 1946, Sir Shri Ram, the Chairman of the Heavy Chemicals Panel announced that he had just been informed of the decision of the Government of India, that they did not think it necessary to fix any targets or location for Heavy Chemicals and Electro-chemical Industries. This was certainly unexpected. The value of all planning lies in a proper and organized control of the development of industries in different areas having regard to the availability of raw materials in the different areas and proximity to markets. Targets and location form the core of any intelligent planning and no rational planning is possible without them. If the Panels, after thorough consideration during a period of nearly a year, are not to make any recommendations on these points, we feel that all our work may be considered to have been wasted. There was also unanimity of opinion in that meeting of Provincial and State Government representatives that this decision of the Government would lead to chaos as it would enable persons to start industries wherever they liked. We have retained the contents of the report as they were before we were informed of this decision of the Government, as we feel strongly that Government control as regards targets and location is essential. We hope the Government of India will reconsider their decision in the light of our views and also of those expressed by all the representatives of the Provincial and State Governments.

PART I.

HEAVY CHEMICALS.

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tons being available for sale. When the other two plants with a total annual capacity of 13,500 tons are installed, the total productive capacity inclusive of the quantity available in the Travancore plant will be 93,500 tons. The balance required to make up the target figure will be 59,100 tons.

10. Appendix III gives the production of sulphuric acid in India in 1944 area-wise, from which it is seen that the greatest production was in Bihar and Bengal (many of the plants produced the acid for their own consumption). There was no production in the C. P.

11. Before suggesting location of new plants, we wish to make certain observations:—

(i) One important feature of sulphuric acid production is that it must be manufactured at or very near the place of consumption. The cost of transport even in steel drums or tank cars is high in proportion to the value of the product.

(ii) Out of about 41 plants in India including the four new ones, only 9 are contact plants, the rest being chamber plants, many of them old and inefficient. Further, there are about 10-12 plants, each with a capacity of less than 500 tons which, although working at a profit now, will not be able to withstand competition in normal times, except in those rare cases where they are situated in inaccessible places. They will have to be scrapped sooner or later, thus reducing the productive capacity in the country by about 3,000 tons. Further, most of the old chamber plants will have to be replaced and in many instances, we understand the owners are already taking steps in this direction.

(iii) Since there are no known deposits of element sulphur in India—the small quantity available at Koh-i-Sultan has not proved economical—we consider that immediate steps should be taken by Government to utilise the enormous quantities of gypsum available in the country, for the manufacture of sulphuric acid and for conversion into sulphur. We would specially lay stress on the latter, because gypsum deposits occur mostly in the Punjab and Rajputana, where sulphuric acid is not required in any large quantity. Transport of gypsum to different parts of India would involve carriage of five times the weight of sulphur contained in the mineral. In view of the intricate nature of the chemical process and the financial risk involved, it is possible that private capital will not be forthcoming to start this industry. Therefore, we recommend that Government should immediately instal a plant of proved efficiency and sound design for the manufacture of 35 tons of sulphuric acid and of 12 tons of sulphur per day from gypsum, cement being obtained as a by-product. Large deposits of gypsum occur in the Punjab and Rajputana and we are of the opinion that the Government experimental factory should be located in one of these two areas in the North. This Government experimental plant will be mainly for purposes of training technical personnel and investigation of the economics of the process. It will also be found useful in time of war when India will be cut off from sulphur sources. Since manufacture of sulphuric acid and sulphur from gypsum is not yet a well-standardised process, we recommend that the Government of India should depute Indian technologists of experience in sulphuric acid manufacture and industrialists associated with this industry to foreign countries to study the economics and the technical aspects of the processes in practice in different countries and on their

recommendation, orders should be placed for the most efficient plant. If it is found that sulphur can be manufactured by this process at a competitive price in comparison with the imported material, more factories can be put up and the country made independent of imported sulphur. In this connection, we would refer to the South India plant for the manufacture of 35 tons of sulphuric acid per day from gypsum (vide para 9) and suggest that the *entrepreneurs* may be advised to take up the manufacture of sulphur in addition to the acid; their results would give us valuable data. We also recommend that the possibility of importing Spanish pyrites from which copper and sulphuric acid can be manufactured should be examined. This, if found economical, will prove to be of great benefit as the Indian resources of copper are slender. We understand that the Government of Bihar have under consideration a scheme for starting a spelter industry from imported zinc concentrates. We support this scheme which would enable both zinc and sulphuric acid to be manufactured.

12. Taking into consideration the small consumption of chemicals in different parts of India and the small rayon units proposed to be installed, we are of the opinion that plants of large capacity as in the U.S.A., U.K. or Germany are not suitable for Indian conditions. Although small units may prove less economical on account of large overhead charges and comparatively large initial cost, we consider that the saving in transport and distribution would more than outweigh these advantages.

13. We are of the opinion that 20 to 25-ton-per-day sulphuric acid plants are suitable economic units, but taking into consideration the special conditions in India, we recommend that 10-ton-per-day units would be the most suitable except in special cases where larger units would be justified. On this basis, for the extra production of 59,100 tons required, fifteen units will be necessary in addition to the Government gypsum-sulphuric acid experimental plant of 10,500 tons capacity. We suggest that of these, plants with a total capacity of 30,000 tons may be located as follows:—

(i) *Sind*: There is at present only a very small plant which may not survive competition in the post-war period. This province is isolated form other parts of India and inaccessible and has also large tracts of land brought under the plough as a result of the Sukkur Barrage. Therefore, largely to provide acid for the manufacture of badly needed phosphate fertilisers, it seems desirable that a plant of at least 3,000 tons capacity should be established there.

(ii) *Bombay*: In view of the large developments contemplated in other industries, it is likely that consumption of acid in this area will go up. Therefore, installation in that area of one or two plants producing 6,000 tons in the aggregate would be desirable.

(iii) *Bihar*: For the extra production of ammonium sulphate in coal distillation plants in Bihar, about 13,000 tons of acid will be required. Therefore, installation in that area of two or three plants of 13,000 tons total capacity is necessary. We also understand that the Government of Bihar has approved of a scheme for the manufacture of 15,000 tons of superphosphate which would require 15,000 tons of sulphuric acid. For this purpose, a plant of 15 tons capacity per day would be necessary.

(iv) *C. P.*: There is no manufacture of sulphuric acid in this

Province, but large developments are contemplated by the Provincial Post-war Planning Committee. A 3,000-ton plant may therefore be installed there. This will be exclusive of any demand that might arise due to the installation of steel plant in this province.

When the Government experimental plant of capacity 10,500 tons per year recommended in para II (ii) and the plants mentioned above are all installed, capacity will be increased by 40,500 tons per year. The balance of 18,600 tons will have to be allocated after the location of rayon plants by the Rayon Panel is decided.

14. With reference to the General Directive, we wish to make the following remarks:—

3(1-A) Including freight and insurance charges, the cost of each of the 10-ton plants with equipment for producing oleum also, imported recently from the U.S.A. was $75,000. Therefore, the capital goods (to be imported) requirements for the 15 plants are estimated at about $11,25,000 or 37.5 lakhs of rupees. The cost of the Government experimental plant is not included in this figure, as we are not able to estimate it. Appendix IV gives the list of sulphuric acid plant equipment that can be manufactured in India. This has not been taken into account in the above estimate, as it is not possible at this stage to work out the cost of manufacture in India.

3(2) All the plants except the Government gypsum-sulphur and sulphuric acid plant should be permitted to be installed by private industrialists.

3(3) Vide replies to 3(1-A) and 3(2).

3(4) Foreign technical experts would be necessary only for the Government experimental plant.

3(4-A) Some scholars proceeding to U.K. and U.S.A. may be directed to specialise in this work. In our opinion, the Government experimental plant will require three chemists and three engineers and each of the other plants one chemist and one engineer.

3(5) None

3(6) Vide para 13.

3(7) Government should have a staff of experts who should pay occasional visits to the different factories on request, at a fee if necessary. This would conduce to a general increase of efficiency in the industry.

Since large quantities of sulphur are purchased annually both for the acid plants and sugar factories, we consider it desirable that the whole quantity should be purchased by a single corporation—Government—aided or otherwise—deliveries being arranged at such intervals as will enable minimum tonnages entitled to special freight rates to be imported.

We understand that at present, most of the sulphur is imported packed in gunny bags which raises its cost appreciably. Arrangements should be made to import sulphur loose; facilities should be provided for unloading it in Indian ports and for transporting it in railways.

These would result in cheaper sulphur.

We consider that the present tariff rates on the acid are sufficient.

3(7-A) There is no import duty on sulphur which is not available in India and there is a revenue duty of 30% *ad valorem* on sulphuric acid. Therefore, until the manufacture of sulphur in India is established consideration of (7-A) does not arise.

3(8) We understand that even at present chamber plants of small capacity are being erected in different parts of the country without any control. We consider this harmful to a healthy growth of this industry and are of the opinion that chamber plants should not ordinarily be allowed to be installed unless the acid manufactured is for consumption in the plant itself and not for sale.

As far as possible, chamber acid should be used without further concentration for the manufacture of fertilisers, contact acid being reserved for special uses; exception may be made only in very special cases.

Wherever waste acid is available, its use for the manufacture of fertilisers and sulphates should be encouraged.

Ceiling prices should be fixed by the Government periodically on the basis of a fair margin of profit over the cost of manufacture. This is necessary, since cheap acid is essential for development of consumer industries. Although on account of its corrosive nature and high cost of transport, the acid enjoys virtual protection, solid products such as salts and dichromates prepared from sulphuric acid do not possess these advantages and cannot be developed if they are not assured of a supply of cheap acid.

3(9) To safeguard the interests of the industry, an association of Sulphuric Acid Manufacturers should be formed. We are not in favour of cartels.

3(10) Vide para 7.

3(11) In the present stage of development of the industry, we do not think there is any prospect of export. When the industry is well established, this question will have to be taken up.

3(12) There is no possibility of a cottage industry.

Note.—All the figures given in this section refer to 100 per cent. Sulphuric Acid.

SULPHATES.

I (b) (1) Sulphate of Alumina. Alums.

15. Alumino-ferric, i.e., sulphate of alumina with a small quantity of iron present as an impurity is largely used for purification of water supplies and sizing in paper industry. For use as a mordant in dyeing and printing of cotton textiles, sulphate of alumina free from iron is required. Alums (double salts with sulphate of alumina) are also used in dyeing, paper-making, tanning and textile industries. The raw materials required of alumina are bauxite which is available in large quantities in India and sulphuric acid. The process of manufacture is quite simple, no elaborate plant being required. The salt has been prepared by the sulphuric acid manufacturers for some years.

16. Present production is 16,000—17,000 tons per year, total requirements being about 20,000—21,000 tons. Taking into account the expansion planned in the paper and other industries, and the expected increased consumption of the chemical in water purification,

we consider that a five-year-target of 38,000 tons as shown in Table V would be suitable.

TABLE V.

	Present consumption	Five-year target.
	Tons.	Tons.
Paper industry	10,000	20,000
Water purification	8,500	14,000
Others	2,000	4,000
	20,500	38,000

17. Since the quantity manufactured at present is all consumed locally, there is no immediate likelihood of export. When, however, there is increased manufacture, the question of export will have to be re-examined. This is one of those industries for which the raw materials are available in India and on this account it deserves special encouragement. We recommend that such protection as will enable it to develop successfully should be given to this industry.

(ii) Magnesium Sulphate (Epsom Salt).

18. This salt is used extensively in medicine, in the finishing of cotton fabrics, for weighting silk, paper and leather and for textile dyeing. In medicine, it is used in the form of Epsom salt. Before the war, imports of this salt were about 600 tons per annum mostly from Germany where it is obtained from the well-known potash deposits at Stassfurt. In India, it was made mostly by treating magnesite with sulphuric acid, but now it is also being recovered from bitterns. The total Indian production is estimated at about 3,500—4,000 tons and can be increased, if required, without any special difficulty. We do not consider any special efforts necessary.

(iii) Iron Sulphate (Green copperas).

19. Green copperas is hydrated ferrous sulphate used largely for the manufacture of ink and in the paint industry. It is obtained by dissolving scrap iron in sulphuric acid. As a matter of fact, large quantities are obtained as a by-product in the pickling industry in the steel plants. The present production of about 2,000 tons per annum is more than sufficient and can be increased, if necessary. No action is required in this case.

(iv) Copper Sulphate.

20. Copper sulphate is used principally as a fungicide, the chief purchasers being coffee, tea and rubber estates and the Department of Agriculture. It is made from scrap copper and sulphuric acid, Imports into India have been about 1,800—1,900 tons per annum, agriculture taking up 80 per cent. of the material. Defence requirements were 2,000 tons for rot-proofing of bags, but this demand is fast disappearing. Estimated Indian production per annum is about 900 tons. Although copper sulphate is an important chemical required in agriculture for destruction of pests, we consider that the slender copper resources of India should not be used for the manufacture of copper sulphate, but should be utilised for more important purposes. The possibility of manufacturing copper sulphate from imported copper

pyrites may be examined. Large quantities of copper sulphate would, however, be necessary for use in agriculture and this demand is expected to increase with greater applicability of scientific methods of control. Since this will be for the benefit of the ryot, we recommend that the copper sulphate imported for agricultural purposes should be free of duty.

(v) Sodium Sulphate.

21. Sodium sulphate is employed in the manufacture of wood pulp and glass, and in the textile industry as an auxiliary in the dyeing of cotton and wool. Purified and crystallised, it is known as Glauber's salt, Na_2, SO_4, $10H_2O$ and is used in medicine in large quantities. Pre-war consumption of sodium sulphate which is obtained as a by-product (salt-cake) in the manufacture of hydrochloric acid was about 3,000—4,000 tons. Production used to be about 2,000 tons and imports about 1,700 tons. Recently, large deposits of the salt have been discovered in the Didwana Salt Range in Jodhpur. We do not therefore consider that any special efforts for manufacture are necessary and do not suggest any target.

OTHER SULPHUR COMPOUNDS.

(c) (i) Sodium Sulphide.

22. Sodium sulphide is used as a depilatory in the tanning industry for dehairing hides, in textiles as a developer of sulphur dyes, as a causticising agent in paper industry and to a small extent in photography. Pre-war imports were about 2,000—3,000 tons, there being no manufacture in India. We understand small quantities are now being manufactured. Textiles, leather, paper and other industries consume about 3,700 tons of this chemical. Taking into consideration the expansion planned for in these industries during the next five years, we expect a larger consumption of sodium sulphide as detailed in Table VI and therefore recommend a five-year target of 7,000 tons per year.

TABLE

	Present consumption.	Five-year target of production.
	Tons.	Tons.
Textiles	2,500	4,500
Leather	500	1,000
Soda ash plants	600	1,250
Paper	100	250
About ...	3,700	

23. We understand that the Jodhpur State has undertaken the manufacture of this chemical. We have no doubt that the State authorities are fully alive to the importance of making arrangements for the prdouction of all the sodium sulphide required in India, within a reasonable time and making it available to the consumers at reasonable

prices. If, however, this scheme does not become successful within a period of one year, the Government of India should make other arrangements. We also recommend that at the same time alternative sources should be developed. Sodium sulphate is obtained as a by-product in dichromate and hydrochloric acid plants and the management of these factories should be encouraged to manufacture sodium sulphide by the grant of special concessions.

(c) (i) Sodium Sulphite.

24. Sodium sulphite is employed in India mainly in photography and to a small extent in some industries. Pre-war imports were 100 tons per year. Present production is adequate and we do not consider any special steps necessary.

(ii) Sodium Thiosulphate. (Hypo).

25. The pre-war requirements of sodium thiosulphate which is used chiefly in photography (80 per cent.) and to a small extent for leather (20 per cent.), were of the order of 500 tons. There was no manufacture in India before the war. But now, production has been started by a number of firms, plants of 300—500 tons capacity having been put up recently. It is expected that local manufacture will cover the requirements; we, however, consider that this infant industry should be protected.

(iv) Sodium Hydrosulphite (Hydros).

26. Sodium hydrosulphite is an important chemical used in the textile and sugar industries. Pre-war requirements were about 1,600 tons per annum, 80 per cent. of which was used in dyeing, 15 per cent. for sugar manufacture and 5 per cent. for miscellaneous purposes. We suggest a five-year-target of 2,500—3,000 tons. We understand that the manufacture of this salt has not been taken up in India, cheap zinc and sulphur dioxide being necessary for its economical production. We recommend that investigations which are being carried out by the Council of Scientific and industrial Research on the possibility of developing alternative processes utilising Indian raw materials should be continued.

II. ALKALI INDUSTRIES

27. One of the most important operations in Chemical Industry is the manufacture of alkali, which is essential for the manufacture of many of the goods in everyday use. Glass, soap, paper and textiles are all alkali products, while vegetable ghee, leather, disinfectants, dyes and numerous other industries require alkali for their manufacture. Chlorine, one of the products of the caustic alkali industry is essential for water purification, in the paper and textile industries and for manufacture of chlorinated solvents, medicinal preparations and dyes.

(a) Common Salt.

28. Common salt is the most important raw material of the alkali industry, finding use directly as such in LeBlanc, ammonia-soda, electrolytic caustic, glass, leather, soap, textile, paper, ceramic, enamel and other industries. It is also a preservative and is used in fish-curing, meat-packing, dairying and other industries. It is the preponderant mineral constituent of sea water and also of the deposits which have resulted from the desiccation of ancient lakes and seas. Salt is

chiefly used in India for edible purposes, its use in industries being very small compared with that in other industrial countries. But hereafter, when industrial development takes place, the consumption of salt will naturally go up enormously and it will be necessary to provide for this increase. The total consumption of salt in India is about 2·25 million tons of which Heavy Chemical Industries recently established are estimated to consume about 225,000 tons; but with the development of new industries this may be expected to increase to half-a-million tons easily.

29. Complaints have been received that salt is abnormally expensive, especially in Bengal, resulting thereby in higher cost of alkali, which, in turn, affects the cost of manufacture of other products. As regards purity, although the salt available at present is suitable for most purposes, its purity is not sufficiently high for use in the alkali industry, as can be seen from the analysis of the different types of salt manufactured in India and of that used in the U. S. A. for alkali industries (Appendix V). We are, therefore, of the opinion that in order to establish a successful alkali industry in India, pure salt must be supplied at cost price. Because of the necessity of transport over long distances between the factories and the centres of salt manufacture, special railway freight concessions are also necessary. In view of the importance of this subject, the Central Board of Revenue arranged, at our request, for Mr. H. A. C. Gill, Collector of Central Excise and Dr. S. S. Aiyar, Chief Chemist, Central Board of Revenue, to meet the Panel in order to clarify some points about the manufacture and supply of common salt to chemical industries. We give below the points clarified as a result of discussion:—

(i) It was suggested that the C.B.R. should permit manufacturers of common salt to use such methods of purification as would make the salt suitable for use directly in their industries. The officers did not anticipate any trouble in permitting this to be done.

(ii) The Panel wanted that the C.B.R. should supply pure salt to all industries. The representatives said that conditions varied in different places, the source being rock salt in some places and brine in the others. It would be, therefore, difficult to lay down a unifom policy for all places.

(iii) A request was made that owners of salt pans who manufactured salt for industries should be permitted to remove small qunatities brine for purposes of experiment after paying duty if necessary. Mr. Gill said there was no objection to it.

(iv) The Panel was of the opinion that by-products of bitterns should be permitted to be recovered. The reply was that this was permitted and even encouraged.

(v) The Panel desired that the use of brine for recovery of salt should be permitted all the year round. It was stated in reply that that in a few places, climatic conditions were against working of salt pans all the year round; otherwise, no objection could be seen.

(vi) The Panel was keen that the price of salt should be reduced by improved methods of manufacture. It was stated in reply that although just at present, due to increased cost of manufacture, the price of salt was a little higher than usual, normal price was as low

as cost of manufacture permitted. At the salt sources controlled by the Government of India, salt was sold at cost price and all possible methods were being applied to produce the salt at the lowest possible cost. (We understand, however, from Messrs.. Imperial Chemical Industries that while stlt was being supplied to their Rishra plant at Rs. 75 per 100 mds. in 1940, the present price is Rs. 400 for many of the consignments. This would seem to require examinaton in view of the statement made by the Collector of Central Excise). The question of introducing improved method in privately owned salt works was outside the scope of the Central Excise Department; but if individual manufacturers could reduce the price still further by improved methods, there would, of course, be no objection from the point of view of the Government Salt Works.

(vii) It was suggested that salt dust should be given free of charge or at least at the same uniform rate to all industries. Salt dust, it was stated, was being isssued at the same uniform rate to all industries, except that under the terms of a contract entered into with the Alkali & Chemical Corporation of India the waste salt of Khewra Mine, which includes salt dust and marl, to which they were entitled under their agreement, was being issued to their Khewra factory at a special fixedrate . Limited quantities of dust salt from Warcha mine and of crushed salt from Khewra mine were being issued, it was stated, to other industrial concerns to the extent available.

(b) Lime.

30. Slacked lime is used in enormous quantities for preparation of mortar and to a smaller extent in the sugar industry and in a large variety of chemical operations, being the cheapest form of alkali. It is an essential raw material for causticising soda ash and for liberating ammonia from ammonium salts as in the soda ash industry. Estimated consumption in chemical industries in India is about half-a-million tons. Large quanties of limestone sufficiently pure for use in industry are stated to be available at a number of centres, but the information available (Appendix VI) seems to be insufficient, since chemical analysis of limestone will not by itself give an indication of its easy convertibility to lime by burning in the kiln. We consider this information essential for the location and successful working of important chemical industries depending on lime and recommend that the C.S.I.R. should investigate the burning qualities of the different samples of limestone available in India, in collaboration with the Geological Survey of India. We are also of the opinion that complete information about the quantities of limestone available, uniformity of grade and analysis should be collected and made available to the industrialists. It is essential that chemical industries should be able to obtain lime of guaranteed quality for their use. Although lime of good quality is produced in soda ash plants, it is consumed in the plants themselves. At present there is no plant in India manufacturing lime by modern processes, for supply to chemical industries, especially to the sugar factories, where it is essential. We are, therefore, of the opinion that Provincial Governments should encourage the installation of modern lime kilns suitable for burning the limestone available in the province to supply high grade lime to the sugar and other chemical industries.

(c) **Soda Ash.**

31. Soda ash is one of the most extensively used chemicals in the world, glass industry alone consuming a fourth of the production. World production in 1941 by the chemical process was about 6 million tons. Large deposits of this chemical also occur in different parts of the world,—in Mexico, Persia, Southern Russia, California and the Magadi lake in British East Africa. An analysis of consumption of soda ash in the U.S.A. in 1940 is as follows:—

TABLE VII

	Tons.
Glass	807,000
Soap	163,000
Caustic and bicarbonate	700,000
Other chemicals	634,000
Cleaners and modified sodas	121,000
Pulp and paper	99,000
Water softeners	29,000
Petroleum refining	11,000
Textiles	40,000
Exports	54,000
Miscellaneous	165,000
	2,823,000

(Roger's Industrial Chemistry).

In India, about 107,500 tons of soda ash were consumed in 1944, as detailed below:—

TABLE VIII

	Present consumption	Five-years target.
	Tons.	Tons.
Glass	25,000	50,000
Paper	12,000	24,000
Textiles	9,000	12,500
Dichromates	5,000	5,000
Sodium Silicate	3,500	3,500
Ordinance factories ... .., ...	3,000	3,000
Misc. Chemical industries	2,000	4,000
Washing and cleaning	48,000	70,000
For manufacture of 57,000 tons of caustic soda	...	95,000
	107,500	267,000
		(or about 270,000 tons).

32. There are three soda ash plants in India at present, but although their capacity has been of the order of 74,000 tons per annum (Table IX), actual production has been only about a half of it.

TABLE IX.

	Tons.
Dhrangadhra Chemical Works	18,000
Tata Chemical Mithapur	36,000
I.C.I. Plant at Khewra	20,000
	74,000

As we have stated before, soda ash is essential for glass, paper and other industries, which have all been established in India and are expected to expand in the post-war period. As detailed in Table VIII, taking into account the expansion of these and other soda-ash-consuming industries during the next five years planned by the respective panels, we are of the opinion that a five-year-target of 270,000 tons should be aimed at. This target includes the soda ash required for manufacturing 57,000 tons of caustic soda by the causticising process (para 50). If we assume that the present capacity will be translated into production soon, the balance of productive capacity to achieve the target will be 196,000 tons.

33. We understand that one of the present plants is planning expansion from a production of 18,000 tons to 24,000—30,000 tons per year and that the Government of India have granted an import licence to a firm in Madras Presidency for one plant of capacity 15,000 tons per year in the first instance, to be later raised to 30,000 tons. Extra production to be arranged for would, therefore, be about 160,000 tons. This is an industry which has been established in other countries on the basis of plants of large capacity—about 70,000—100,000 tons per annum. For Indian conditions, this scale of operation may not be practicable. We consider, however, that plants of fairly large capacity are necessary and recommend that four units, two of 50,000 tons each and two of 30,000 tons each be installed.

Location.—Without a detailed examination of all the conditions necessary for the proper location of a soda ash plant, it is difficult to suggest exact locations for the four plants mentioned above. Each ton of soda ash requires for its manufacture 1.7—1.8 tons of salt. 1.3—1.5 tons of limestone, 0.1—0.11 ton of coke and 0.7—1.05 tons of coal in addition to small quantities of ammonia. Further, plenty of water is required—2,000—2,500 Cft., i.e., about 12,250—15,500 gallons per ton of soda ash. Punjab is the only Province where almost all the raw materials are available, but there is already a plant working there. Sind has both salt and limestone; coal and coke will have to be transported. Bihar has limestone, coal and coke; salt will have to be transported. South India near one of the sea coast towns has both limestone and salt; coal and coke will have to be transported. The Central Provinces have both limestone and coal; salt and coke will have to be transported. Therefore, it is seen that all the raw materials are not available in any part of India except in the Punjab. Taking all the factors into consideration, we recommend that the four soda ash plants be located as follows:—

(i) One 50,000-ton plant.—In Sind, as near to Karachi as possible, where both limestone and salt are available. Coal and coke will have to be taken by sea from Bihar via Calcutta.

(ii) One 50,000-ton plant.—In Bihar, near Shahabad where limestone of good quality is available. Salt will have to be taken from the Punjab salt mines or from Sambhar lake. Attempts should also be made to manufacture the necessary amount of salt—about 85,000 tons per year from sea water at the nearest coastal town. Coal and coke are available and ammonia also will be available in the new Sindhri plant.

(iii) One 30,000-ton plant.—In South India, near one of the sea coast towns. Lime will have to be made from shells. Coal and coke can be transported from Bihar via Calcutta.

(iv) One 30,000 ton plant.—In the Central Provinces.

The availability of water and raw materials near the selected site has to be examined in consultation with the Provincial Governments.

It may be mentioned that the consumption of soda ash in the different parts of India is as follows:—

	1939-40	1943-44
	Tons.	Tons.
Calcutta Zone (Bengal, Assam, Behar U P. including Delhi, Orissa and a part of C. P.) ...	46,579	30,031
Bombay Zone (Bombay, Central India. a part of C.P. and Rajputana) ...	16,895	30,627
Madras Zone (Madras, Mysore and other South Indian States and a part of Hyderabad) ...	7,830	6,572
Karachi Zone (Sind, Baluchistan, Punjab and N. W. F. P)	14,039	8,898
Total ...	85,343	76,128

34. Small quantities of the chemical now being collected from the Reh deposits in Cutch, Sind, the U.P., Bihar and the C.P., have not been included in the production figure given in Table IX. But this work has not been organised properly and an important source of soda ash is thus not being utilised. We recommend that the Governments of the above-mentioned provinces should organise this collection properly on a cottage industry basis and thus utilise the resources of the country. Soda ash collected in this manner may not be sufficiently pure for chemical industries, but it will be useful for domestic purposes.

35. With regard to the soda ash industry we make the following recommendations with reference to the points in the General Directive to Industrial Panels:—

3(1-A) Taking into consideration the present abnormal conditions as regards price and availabilty of plants, we are not in a position to give the estimated requirements of capital goods in this case with any accuracy. The late Mr. Kapilram Vakil was of the opinion that the pre-war cost of a soda ash plant worked out to Rs. 1,10,000 per ton per day, and on this basis, the pre-war price for plants of total production capacity, 1,60,000 tons per year or about 530 tons per day would be nearly Rs. 6 crores. The present cost would probably be more.

3(2 & 3) We consider this industry, essential by itself and for the manufacture of products in daily use. The manufacture of extra production required to achieve the target should be arranged

for by Government ownership entirely or partly in association with private capital.

3(4 & 4A) For this industry, we consider that technical advice from abroad is necessary. Indian chemists and chemical engineers should, however, be trained as early as possible to take up positions of responsibility. We would suggest, in this connection, that some Government scholars who are being sent abroad for training may be asked to specialise in this industry. We consider 12 chemical engineers in all would be sufficient.

3(7) This industry requires protection, either higher duty or subsidy, but only to such an extent as will not penalise the consuming industries.

3(7-A) Does not apply.

3(8) The chemical should be made available to the consumer at a reasonable price.

3(9) No association or cartel is necessary.

3(10) We consider that the plants should be installed as soon as a survey of the proposed sites is completed.

3(11) We do not consider that there is any likelihood of export, at least for the present.

3(12) There is no possibility of a cottage industry, except the collection from alkaline earth deposits referred to in para 34.

(d) (i) Sodium Bicarbonate.

36. The use of sodium bicarbonate is chiefly in medicinal preparations, food materiais and fire-extinguishers. It also serves as a source of carbon dioxide in baking powders and in artificial minoral waters. India consumes about 6,000—6,500 tons per annum, present production being only about 1,500 tons. As this chemisal depends on soda-ash for its manufacture, it would be comparatively easy to develop it when soda-ash production is increased. We do not consider it necessary to make any special recommendation.

(ii) Sodium Silicate.

37. Sodium silicate is employed in the lining of casks, weighting of silk and in the manufacture of soaps of cheaper quality. It is also employed as an adhesive either alone or with cement materials in the making of concrete surfaces. The manufacture is fairly simple, the chemical being produced when soda-ash and clean sand are heated in a special furnace. It is difficult to estimate the production of sodium silicate in India, as manufacture is carried on by small firms, all over the country. The only indicator is the quantity of soda-ash issued for the purpose which, in 1943 was 3,500 tons. The preparation is comparatively easy and a number of manufacturers have taken it up; but modern methods are not used and the quality of the product is not good. We consider that improvements must be effected in both these respects. Success of this industry would, however, depend on the price of soda-ash.

(iii) Cyanides and Ferro-Cyanides.

38. Sodium cyanide in the presence of oxygen dissolve almost all metals except lead and platinum and this property is made use of in the

extraction of gold and silver from their ores. It is also used in case-hardening of steel and in electro-plating. Calcium cyanide is used in fumigation since it is easily hydrolysed by water, evolving hydrogen cyanide possessing lethal properties. Ferro-cyanides are used in admixture with other products like starch etc., for the manufacture of commercial blues. In India, sodium cyanide is used chiefly in Kolar Gold Fields, Mysore State, for the extraction of gold, average consumption per year being about 200 tons valued at Rs. 2.5 lakhs. Since the quantity required is not very large and there is only one large consumer, we do not consider it necessary to recommend any steps to manufacture this product immediately.

(e) Caustic Soda, Caustic Potash and Chlorine.

39. Caustic soda is one of the most important heavy shemicals, its principal uses being in the rayon, soap, paper, mercerized cotton, explosives, dyestuffs, vegetable oils, chemical and other industries. From published data, we find that a quantity of nearly a million tons was produced in 1940 in the United States and disposed of as shown below:—

TABLE X

	Tons.
Soap	85,000
Chemicals	196,000
Petroleum refining	79,000
Rayon and cellulose film	205,000
Lye	42,500
Textitle	42,500
Rubber reclaiming	18,000
Vegetable oils	14,000
Pulp and paper...	47,000
Exports	93,000
Miscellaneous uses	155,000
	977,000

40. In India, manufacture has been developed only to a small extent but consumption is appreciable and is likely to increase hereafter. On the basis of unrestricted off-take of the existing consumer industries, about 54,000 tons of caustic soda are required annually.

TABLE XI.

	Present consumption.		Five-year target.
	%age.	Quantity.	
		Tons.	Tons.
Soap	43·6	23,500	52,000
Textiles	28·5	15,400	21,000
Paper	16·6	9,000	18,000
Miscellaneous including oil-refining, vegetable ghee, etc ...	11·1	6,000	12,000
For the manufacture of 60 tons of viscose rayon per day	...	...	30,000
	About	54,000	133,000

41. The present Indian capacity for manufacture is 12,600 tons per annum, and with the three electrolytic plants which are expected from the U.S.A. productive capacity will go up to 17,600 tons; manufacture will still be largely short of consumption. No country can afford to depend on imports of this essential chemical. Consumer industries are well established in India and can be easily developed: we therefore, consider it essential that caustic soda production in India should be stepped up as early as possible.

42. Both the methods of manufacture, electrolysis of brine and causticising of soda ash are being used more or less to an equal extent in other countries, although there is a general tendency to change over gradually to the electrolytic process as can be seen from the following table of production in the U.S.A.:—

TABLE XII.

	Lime-Soda.	Electrolytic.	Total
	Tons	Tons	Tons
1921	146,000	67,400	213,400
1925	318,000	126,320	444,000
1929	469,000	217,000	683,000
1933	392,000	221,000	613,000
1937	436,000	429,000	865,000
1939	474,000	441,000	915,000
1940	446,000	531,000	977,000

(Rogers' Industrial Chemistry).

Electrolytic Alkali.

43. Capacity to utilise chlorine obtained in an almost equal quantity sets a limit to the adoption of the electrolytic process. In the U.S.A., new uses of chlorine have been developed because of the urgent need for finding fresh outlets for the large quantity of chlorine produced in the electrolytic caustic industry. These new uses have been developed to such an extent that now there is actually a move towards chlorine without alkali. The percentage consumption of the large quantities of chlorine produced in the U.S.A. is as follows:—

TABLE XIII.

	%
Pulp bleaching	21
Chlorination products	60
Disinfectants and sanitation	6
Textiles	5
Miscellaneous uses	8

44. The prospect of our developing all these lines in India immediately does not look promising, although the need is there. To take

one instance, 21 per cent. of chlorine produced in U.S.A. or about 90,000 tons were used for bleaching pulp, a substantial portion of which was used for paper manufacture. Population of India is three times that of the U.S.A. and when universal compulsory education is introduced, as has been visualised, the demand for paper will be enormous and we estimate that India will require more than 100,000 tons of chlorine for bleaching pulp. This will, however, form a long-term programme, the question being bound up with the educational policy of the Government and expansion programme of the paper industry. For the present, we understand that the Paper Panel has fixed a five-year-target of double the present production of 62,000 tons of white paper per annum. To revert to Table XIII, chlorination products include a large variety of chemicals. Carbon tetrachloride, chlorinated naphthalenes, chloroform, refrigerants and hypochlorites consume large quantities; extraction of bromine from sea water and chlorinated rubber are responsible for a good off-take. Treatment of drinking water, of sewage and effluents from industrial plants, and of water in swimming pools uses up 6 per cent. If electrolytic caustic industry is to be developed in India, proper disposal of chlorine is essential. This problem is important from two aspects—the higher cost of caustic due to non-utilisation of chlorine and what is equally serious, the disposal of the poisonous gas produced.

45. We consider that in addition to pulp manufacture, which will be the obvious large outlet for chlorine, the most promising lines are manufacture of DDT and hexachlorocyclohexane (benzene hexachloride; 666) the two most valuable insecticides. In a country where malaria takes its heavy annual toll and there is enormous damage to crops by insect pests, the importance of these two chemicals cannot be over-emphasized. In the absence of definite programmes of the Departments of Public Health and of Agriculture, it is difficult to estimate the possible annual requirements. We understand from the Public Health Commissioner to the Government of India that while he finds it difficult to forecast the probable requirements of DDT and 666 with any degree of accuracy for the next five years due to the results of large scale field controls not being ready, he does not consider that the average demand over the next five years is likely to exceed 5,000 tons per year for anti-malaria purposes only. This was clarified by the Deputy Public Health Commissioner in a discussion with the Panel. With the present grants and on the cost of DDT, which is, exclusive of the solvents and cost of preparation of the final spray, about Rs.9,000 per ton, we understood that more than 5,000 tons could not possibly be used. We consider this price of DDT very high. While its published price in England is 4 shilling per lb., it is only 26 cents or about 15 annas to 1 rupee in the U.S.A. Therefore, if the material can be had at a lower price, it should be possible to use more of it. The army authorities seem to be of the opinion that the dosage to be aimed at should be 2.4 ounces of DDT per acre. About three applications per season would be necessary and this would have to be done over large areas. The estimate of the Public Health Commissiner does not seem to include the whole of India. Further, agricultural uses and other civilian uses such as spraying in homes to kill mosquitos, flies, etc., have to be taken into account. Taking all these into consideration, we are of the opinion that an eventual annual target of 30,000 tons in all of DDT and 666 should be aimed at.

(a) 30,000 tons of DDT would require about 75,000 tons of chlorine for its manufacture. The complicating factor, however, is the disposal of large quantities of hydrochloric acid obtained as a by-product. In addition to the acid produced in the manufacture of chlorobenzene and chloral, the two components for the production of DDT, large quantities are also produced due to the formation of dichlorobenzene in appreciable quantities. Actually, about 40,000—45,000 tons of hydrochloric acid will be obtained as a by-product.

(b) 666 is easily made by the addition of chlorine to benzene and the production of hydrochloric acid is small. There are four isomers produced, only one of which is 15 times as active as DDT for insecticidal purposes, the other three being inert. The active component is, however, produced only to the extent of 10—12 per cent. the remaining 88—90 per cent. being useless, according to the information available at present. Since, however, a mixture of all the four isomers is almost as active as DDT, it may be more practicable to use the crude product as such for most purposes. 30,000 tons of 666 require about 22,000 tons of chlorine.

In view of the established production of both these chemicals on a large scale in other countries and possibility of shortage of benzene in India due to manufacture of dyestuffs, we are of the opinion that this scheme should be taken up gradually after the programme of the Government is known. The manufacture of benzene hexachloride will obviously have to be done near the coal distillation plants in Bihar. Even for DDT, we recommend that in order to avoid the transport of benzene which is inflammable, to different parts of the country, chlorobenzene, should be prepared near the coal distillation plants and transported to the different parts of India. We are of the opinion, however, that in the first instance, a central alkali plant of 10,000 tons annual chlorine capacity (11,400 tons caustic) should be installed for this purpose in Bihar. The balance of 10,000 tons of chlorine would have to be distributed in different areas in close proximity to distilleries. It is therefore seen that for the present, only 20,000 tons of chlorine will be used per annum for the manufacture of these insecticides the production of which will be limited to that extent.

46. For all other uses, such as water purification, textiles, paper industry etc., about 10,000 tons of chlorine in addition to the present consumption in different forms estimated at about 10,000 tons per year would be necessary. We, therefore, fix the five-year-target for chlorine at 40,000 tons per annum, the corresponding target for electrolytic alkali being 45,000 tons.

47. Present productive capacity is, as stated already, 12,600 tons of caustic soda per year and with the three new plants, it will be 17,600 tons. Therefore, the balance of production to be arranged for, to realise the five-year-target of 133,000 tons (Table XI) is 115,400 tons. Of the 17,600-ton-capacity, 11,400 is electrolytic and the balance of 6,200 lime-soda. Therefore, the provision to be made for extra production to bridge the gap between the present capacity and the five-year-target is about 33,600 tons of electrolytic alkali and about 82,000 tons of alkali by the lime-soda process for some time to come.

48. Before suggesting the location of plants, we should like to make the following remarks;—

(i) This important industry should be widely distributed as almost all Provincial Governments are taking up hydro-electric schemes on hand:

(ii) In connection with the manufacture of DDT, for which chlorobenzene and chloral are required, sufficiency of Indian production of benzene has to be examined, especially in view of the contemplated manufacture of dyestuffs for which large quantities of this chemical would be required. In order to avoid the transport of this inflammable liquid to the different centres for the manufacture of DDT, we are of opinion that chlorobenzene, one of the ingredients for the manufacture of DDT, should be manufactured at the site of the production of benzene, that is, near the coal distillation plants in Bihar. The resluting chlorobenzene should be transported to the different parts of India. The chlorine required would be available in the central alkali plant to be established in Bihar, as suggested in para 45. Chloral requiring for its manufacture absolute alcohol and chlorine should be made near the distilleries and DDT prepared on the spot by combining chloral with chlorobenzene obtained from the central factory.

(iii) Similarly, the benzene rexachloride also should be made at the site of production of benezene, i.e., in Bihar, where chlorine would be available in the Central alkali plant.

(iv) We understand that very pure caustic soda is required for the Viscose-rayon industry, the chemical made in the diaphragm cell not being sufficiently pure for the purpose. Since only a small quantity of chlorine is required in the viscose-rayon industry, disposal of chlorine obtained simultaneously with the caustic soda would present a problem. To solve this, we are of the opinion that the manufacture of caustic soda for the rayon industry should be linked up with the chlorine required for DDT and benzene hexachloride. In (ii) above, we have suggested that a central alkali plant producing about 10,000 tons of chlorine may be located near the coal fields. This plant will produce about 11,400 tons of caustic soda and we recommend that this plant may be of the mercury cell type, manufacturing caustic soda suitable for use in the rayon industry. Of the 30,000 tons of caustic soda required for the Viscose-rayon industry, the balance of 18,500 tons would have to be made by the lime-soda process or imported for the present.

(v) Common salt, cheap electric power and market for caustic soda and chlorine would decide the location of electrolytic caustic. We would lay special stress on cheap power, 3,500 KWH being required for each ton of caustic soda manufactured. One plant would anyhow have to be installed near Bihar coal fields for the manufacture of chlorobenzene and benzene hexachloride.

49. We understand that the Government of India have granted import licences for 5 ton-per day plants two to be installed in Bombay and one at Porbandar, and a 10-ton plant for Mandi State. It is also understood that Mettur Chemicals are duplicating their plant. Government of Mysore have agreed to the installation of a plant of 8 tons capacity at Bhadravati, near the Mysore Paper Mills. Government of Hyderabad also propose to instal a plant of 5-ton-per-day capacity in Hyderabad. A well-established firm of manufacturers in South India

is contemplating to put up a 8,000-ton plant on the East Coast of the Madras Presidency. All these total up to 21,000 tons. The total production capacity of electrolytic alkali from the existing plants, the three already ordered, the central plant in Bihar and the new plants referred to above would be about 44,000 tons. Since chlorine utilisation is the only limiting factor for the installation of more electrolytic alkali plants, we are of the opinion that these may be permitted to be installed if the applicants can demonstrate a definite scheme for the proper disposal of chlorine.

Lime-Soda-Caustic.

50. The present production capacity of lime-soda is about 6,200 tons and for the balance of about 82,000 tons, we are not suggesting any location immediately, as these plants will naturally be worked in conjunction with the soda ash plants and therefore their location will depend on the location of the latter. Provision for the soda ash required for causticising has been made in the soda-ash-target. It must be remembered, however, that with the increase in consumption of chlorine, production of lime-soda caustic will have to be reduced. Therefore, in the soda ash target, we have provided for sufficient soda ash to give only 57,000 tons of caustic soda, in the belief that after some time, about 25,000 tons more of electrolytic caustic and chlorine can be manufactured and consumed.

Caustic Ptoash.

51. There is no production of caustic potash in India now, but we understand that one firm in Bombay has been given permission to instal a plant. This is expected to be adequate for the present. Since caustic soda and caustic potash are produced by similar processes by the same equipment, there would be no difficulty in expanding production when there is need.

52. In connection with the General Directive to the Industrial Panels, we recommended as follows:—

3(1-A) A rough estimate would be 16 lakhs of rupees for each 5-ton plant.

3(2) We are of the opinion that this industry should be financed by private capital. Only the mercury cell alkali plant in Bihar may be installed by Government.

3(3) Vide replies to 3(1-A) and 3(2).

3(4) We consider that Government should have a staff of technical experts to visit the plants and give them technical advice when required.

3(4-A) There are very few technical men in India, who are familiar with this industry. If possible, we suggest that Government should direct some of the scholars who have been deputed to the U.S.A. and the U.K. to specialise in this work on the basis of one chemical engineer for each plant. Further, the technical personnel in the existing alkali plants should be given facilities for special training abroad.

3(5) We do not consider any help from foreign firms necessary.

3(6) Location has been given in paras. 49 and 50.

3(7) We are of the opinion that this industry should be protected, but since caustic soda is an essential chemical for a large number of

consuming industries, we recommend that such protection as will not penalise the consuming industries should be given. We leave it to the Government to decide which is preferable in the interest of Indian Industry—a higher duty or subsidy, or both.

3 (7-A) Does not apply.

3(8) Vide 3(7).

3(9) To safeguard the interests of the industry, we recommend that caustic soda manufacturers should form an association, but no cartel should be permitted.

3 (10) As regards the stages by which the electrolytic alkali industry should be developed, we are not able to make a recommendation at this stage since the demand will depend on the price of the insecticides. The industry should be developed in consultation with the Departments of Public Health and of Agriculture.

3 (11) We do not think there is any possibility of export.

3 (12) This industry does not lend itself for organisation on a cottage industry basis.

We are of the opinion that the Government should make available to the industry (i) cheap and pure common salt and (ii) electric power at not more than 0·15 anna per KWH.

(f) Potassium Chlorate.

53. Potassium chlorate is used chiefly in the manufacture of matches, in pyrotechnics and blasting powders. The raw materials are potassium chloride, lime and chlorine, all of which are available in India. Cheap electric power is also necessary, power consumption being 6,800—7,000 KWH per ton of chlorate. We understand that pre-war imports were about 2,000 tons, there being no manufacture in India. After the beginning of the war, we understand that Wimcos have developed production to the extent of 1,800 tons per year and some small firms about 100—200 tons each. The present production which is not sufficient for the needs of the country, will have to be stepped up as the demand may be expected to increase still further. Small-scale manufacture independently is uneconomical and it would be desirable to instal chlorate plants as a part of alkali plants so that overhead charges may be reduced. There is only one firm now manufacturing chlorate on a large scale and this monopoly is not desirable, especially as the firm is also a manufacturer of matches. We recommend, therefore, that a plant of 1,000—1,500 tons capacity should be installed in one of the alkali plants.

We understand that potassium chloride manufactured by Indian firms is only 70% pure and not suitable, with the result that it has to be imported from Palestine. We are of the opinion that potassium chloride of suitable quality for this important industry should be prepared in India, the raw material bitterns being available in unlimited quantities.

III (a) HYDROCHLORIC ACID.

54. Hydrochloric acid is an important mineral acid next only to suphuric and nitric acids in importance. Manufacture of ammonium chloride, zinc and other metallic chlorides and cleaning of metals prior to rolling into sheets or coating with zinc, tin or lead,—all these require hydrochloric acid. We understand that pre-war imports were almost negligible, India producing all her requirements by the salt-cake pro-

cess, i.e., by the action of sulphuric acid on common salt. Present production is about 2,500 tons. A more elegant process of manufacture of the pure acid is by direct combination of chlorine and hydrogen both of which are produced when brine is electrolysed. Only one or two firms in India are using this—what is quite a simple process now. In order to eleminate the use of sulphuric acid manufactured from imported sulphur and to provide a suitable outlet for some of the chlorine produced in the electrolytic alkali industry, we consider that all the hydrochloric acid required should be manufactured in this manner and suggest that in future only direct synthesis plants should be permitted to be installed. A quantity of about 1,000 tons of chlorine will be utilised for the manufacture of about 3,000 tons of acid, which we estimate as the probable quantity required per year. Any shortages can be supplemented by the acid obtained as a by-product in organic chlorinations, e.g., manufactured of DDT.

(b) (i) Zinc Chloride.

55. Zinc chloride is used in the textile industry to prevent growth of mildew, as a raw material for the manufacture of dry cells and in a few other industries. Small quantities are being made by the action of hydrochloric acid on zinc dross and skimmings, but to supply the demand, it has been necessary to import 1,800—2,000 tons annually. No special technical difficulty seems to be involved and we understand this manufacture can be developed when cheap zinc residues become available in sufficient quantities. No special action seems to be necessary at this stage.

(ii) Magnesium Chloride.

56. Magnesium chloride finds use in the manufacture of oxy-chloride cements, in the textile industry for sizing, in refrigeration, in the preparation of special floors and also in the manufacture of magnesium. India demand is about 7,000 tons. We understand that two firms in India manufacture it from bitterns; it is also being made by the action of acid on magnesite. Not only is the entire Indian demand met, but small quantities are also exported. No special action is called for.

(iii) Calcium Chloride.

57. The chief uses of calcium chloride are as a refrigerant and as a dust layer on roads. It is obtained as a by-product in the manufacture of potassium chlorate by the chemical process and can be prepared from distiller waste—a waste material available in Solvay soda—ash plants. Pre-war average annual imports used to be about 850 tons and consumption was about the same. Although the present Indian capacity is more than enough to meet the existing requirements, we feel that consumption will increase and future demand may be estimated at 1,500—2,000 tons per year. We understand that expensive chemical processes are being used for manufacturing this chemical. It would be desirable that it should be recovered only as a by-product.

(iv) Potassium Chloride.

58. Potassium chloride is a raw material for the manufacture of potassium chlorate, caustic potash and other important potassium salts like potassium carbonate and bicarbonate. It is also an important fertiliser. Imports into India of the fertiliser grade chemical have been about 3,000 tons per annum. One or two firms are manufactur-

ing it now from bitterns, but the quality is not sufficiently good for the manufacture of potassium chlorate and has to be improved. Potassium chloride is also obtained as by-product in the preliminary refining of crude saltpetre. We are of the opinion that this manufacture should be organised properly and developed when there should be no need for imports.

(v) Barium Chloride.

59. Barium chloride is used in leather tanning and refining of common salt solution to remove sulphates and make it suitable for the manufacture of caustic soda. Small quantities are being made by the manufacturers of electrolytic caustic soda, but the cost of production is abnormally high. We consider that in the interest of Indian alkali industry, one firm should take up production of about 1,000—1,500 tons per year.

IV (a) NITRIC ACID.

60. Nitric acid is used chiefly for the manufacture of nitro-glycerine nitro-cellulose, picrii arid, T.N.T., dyestuffs, pirkling of steel, gold refining manufacture of chemicals, fertilisers, etc. Indian production has usually been from imported sodium nitrate except when indigenous potassium nitrate which is more costly had to be used during the war due to shortage of the imported product. In other parts of the world, the acid is manufactured by oxidation of ammonia, which, if adopted in India, will result in elimination of the use of sulphuric acid. Civil requirements in India are about 750 tons of 65% acid, War Department demands being met by Kirkee and Aruvankadu Ordnance factories, which are using ammonia-oxidation process. Local supply is equal to the demand, which was until recently about 1,300 tons in all.

61. Nitric acid is a very important chemical both for peace-time needs and for the manufacture of explosives and other chemicals used both in peace and in war. The demand is likely to go up in post-war years and we are of the opinion that a rough five-year-target of about 4,000 tons should be aimed at. In view of the reduction of the demand by the War Department, we understand that production has been reduced in Kirkee and Aruvankadu factories and we recommend to Government that this capacity should be utilised for manufacture of peace-time explosives. An ammonia-oxidation plant may be installed later in one of the ammonia plants.

(b) Potassium Nitrate.

62. The important uses of potassium nitrate are as a fertiliser, for manufacture of gunpowder and for nitrepots in the lead chamber process for the manufacture of sulphuric acid and sometimes for the manufacture of nitric acid itself. We understand that large quantities are collected on a cottage industry basis in Bihar, U.P., the Punjab, Patiala, Bikaner and Bharatpur, indigenous production being more than 15,000 tons per year; it is stated that during the first World War, a production of 25,000 tons was reached. Cost of the product seems to be high due to want of proper organisation and of employment of chemical methods, potassium chloride, a by-product not being recovered. We recommend that this industry should be organised properly by the Provincial and State Governments.

V (a) AMMONIA.

63. Ammonia is an important base essential for the manufacture of important ammonium salts, —the important fertiliser ammonium sulphate, and other salts like ammonium chloride, carbonate, bicarbonate and phosphate, for the manufacture of urea and nitric acid, and for use as a refrigerant. A certain quantity is always produced during distillation of coal but this has been developed in India only in a few centres. India produces about 1,500 tons of synthetic ammonia per year, the only existing plant being at Belagula in the Mysore State. We understand that this plant will be duplicated to increase the production of ammonium sulphate. A large plant is being installed at Sindhri in Bihar in connection with the scheme for the manufacture of sulphate of ammonia sponsored by the Government of India and another at Alwaye in Travancore. It is understood that the Government of Hyderabad has under consideration a scheme for the manufacture of 75 tons of ammonia per day which will be used for preparing ammonium sulphate, urea and ammonium nitrate.

64. Synthesis of ammonia is carried out by the direct union of the elements hydrogen and nitrogen. Hydrogen can be prepared either electrolytically or by the water-gas method; Mysore has been using the electrolytic process but the new Government of India and Travancore schemes contemplate manufacture by the water-gas method. Nitrogen is obtained from air by removing the other components. Including all the electrical energy used, 20,000 KWH are required per ton of ammonia produced by the utilisation of electrical power.

65. About 150 tons of ammonia were being imported per year into India before the war, 90% of which was for refrigeration. There was no manufacture of ammonium salts or other products. We are of the opinion that the manufacture of these products should now be taken up. For this purpose, about 12,000—15,000 tons of ammonia per annum will be a suitable target during the next five years, as shown below:—

	Tons.
For ammonium chloride (4.000 tons) and ammenium carbonate (600 tons)	1,500
For nitric acid (3,000—4,000 tons)	2,000—3.000
For urea (10,000 tons)	6,000—7,000
For soda ash plants	4,000—5.000
For refrigeration	200—300

The quantities produced at Mysore, Alwaye and Sindhri are proposed to be used up for the manufacture of ammonium sulphate; but since large quantities of ammonia will be produced at the latter two places, it is expected that the required quantity of ammonia will be made available from these sources for other purposes also, at least for some time to come. The cost of production of ammonia is very high in India and if industries requiring cheap ammonia have to thrive; we consider that it must be made available at a very low price. It is hoped that the ammonia plants will be able to supply cheap ammonia to other industries. At this stage, we do not think it necessary to recommend any new plants, until the proposed plants are installed and successfully worked.

(b) (i) Ammonium Chloride.

66. Ammonium chloride is used as a flux, as one of the ingredients in batteries, for tinning domestic utensils and for miscellaneous other purposes. It is prepared by the combination of hydrochloric acid and ammonia, from calcium chloride obtained from the distiller waste by means of ammonia and carbon dioxide, and also obtained as an intermediate product in the Solvay process. India used to import nearly 2,000 tons of this salt before the war. Present Indian production is negligible. When both ammonia and hydrochloric acid are manufactured in sufficient quantities—large quantities of hydrochloric acid will become available when electrolytic chlorine will be produced in excess of requirements for ordinary purposes—or when soda ash manufacture is further developed, there should be no problem in manufacturing the necessary quantity of ammonium chloride, which we expect will be about 4,000 tons per year in five years.

(ii) & (iii) Ammonium Carbonate and Bicarbonate.

67. The chief use of ammonium carbonate and bicarbonate is in medicine and baking powders. Pre-war imports were about 600 tons per annum. The salts are made by the direct combination of ammonia and carbon dioxide and the manufacture can be established at ammonia production centres.

VI. FERTILISERS.

68. Of the three essential elements necessary for plant food,—nitrogen phosphorus and potassium, nitrogen may be made available to the plant in the form of ammonium sulphate, ammonium nitrate, urea, calcium cyanamide, calcium nitrate or as ammonium phosphate, in addition to what can be supplied in the shape of farmyard manure; phosphorus in its salts, superphosphate and ammonium phosphate; and potassium in potassium nitrate and chloride.

(a) NITROGENOUS FERTILISERS.

(i) Ammonium Sulphate.

69. We do not propose to consider ammonium sulphate as the Government of India have recently examined it carefully. About 6,000 tons are being made in Belagula, 20,000 tons from coke-ovens in Bihar and according to the new schemes, 50,000 tons in Travancore and 350,000 tons at Sindhri, Bihar, are going to be manufactured.

(ii) Urea.

70. Urea contains the largest percentage of nitrogen of all the nitrogenous fertilisers and is a very valuable plant food. It is also a raw material for the manufacture of the important class of urea—plastics, the manufacture of which is under consideration by the Plastics Panel. Urea is manufactured from ammonia and carbon dioxide and can be produced in sufficient quantity when the synthetic ammonia industry is established on a large scale. We recommend that to begin with, a plant of 10,000 tons capacity per year be installed at Sindhri by the Government of India along with Sindhri ammonia plant.

(iii) Ammonium Nitrate.

71. Ammonium nitrate contains nitrogen both in its acid and alkaline portions and has a high nitrogen content. Although it is being used as a nitrogenous fertiliser in other countries, Indian Agricultural Authorities are not in agreement as regards its suitability for India. It would be necessary, however, for the manufacture of explosives. Its production would present no serious problems when both synthetic ammonia and synthetic nitric acid industries are established. We are not making any recommendation now in view of the fact that the question of its suitability for use as a fertiliser and of the establishment of explosives manufacture for civil use is still undecided.

(iv) Potassium and Calcium Nitrates.

72. Potassium nitrate has already been considered in para 62. Calcium nitrate is another fertiliser, manufacture of which can be taken up when cheap nitric acid becomes available.

(v) Calcium Cyanamide.—This is considered in Part II, para 11.

(b) PHOSPHATE FERTILISERS.

73. In the U.S.A. large quantities of these fertilisers are added to the soil in higher proportions than other fertiliser constituents. The main sources of phosphorus are phosphatic rocks and bones, both of which are used extensively. The neutral calcium phosphate in either of these has to be converted to soluble phosphate by the action of sulphuric acid or of phosphoric acid. Phosphate rocks or steamed bonemeal are also used as such for acidic soils or when a slow-acting fertiliser is required. At present in India, superphosphate is prepared by treating bones with sulphuric acid; this a very wasteful method since the other constituents of bones like glue, gelatine, grease and fat are not utilised. Competition with foreign products will be difficult if the industry is worked in this wasteful manner. Therefore, to establish the bone-super-phosphate industry on a sound footing, a large scale factory with facilities for recovery of glue and gelatine for which there is great demand in and outside India, before the bones are treated with sulphuric acid is necessary. At the same time, we recommend that the possibility of using bonemeal itself as a fertiliser to a greater extent than is being done at present, should be examined. This would save sulphuric acid. Another important raw material in India, viz., rock phosphate available in quantities as apatite in Singbhum area and as phosphatic nodules in the Trichinopoly District might well be utilised for the benefit of land. No sustained efforts have been made so far to work up these deposits. We consider, however, that it should be possible to utilise these for the manufacture of fertilisers of low concentration by the thermal process. As already stated (vide para 8) we recommend a five-year target of 100,000 tons per year for superphosphates.

We should like to refer in this connection to the use of ammonium phosphate as a fertiliser. This has the advantage of serving a double purpose since it contains both nitrogen and phosphorus.

74. To eliminate the use of sulphuric acid, it seems desirable to utilise electric power for the manufacture of highly concentrated soluble phosphates. Valuable work has been done in the U. S. A. by

the T.V.A. and a new process has been developed. The process is technically difficult involving, as it does, manufacture of phosphorus from the ore, its conversion to phosphoric acid and combination with the phosphate to form soluble phosphate. Private enterprise may not be forthcoming to start this industry. We, therefore, recommend that Government of India should put up an experimental plant for manufacture of 10 tons of phosphorus per day and concentrated phosphates by the electro-thermal process. In order to conserve the phosphate resources of the country, we are of the opinion that it is necessary to prohibit the export of bones and bonemeal out of India.

Phosphorus.

75. Phosphorus is used mostly in the match industry in the red or amorphous form, apart from its use for manufacture of war chemicals. Small quantities are used for the production of various metallurgical alloys such as phosphor-copper and phosphor-tin. Pre-war imports were about one hundred tons. War Department demand was about 700 tons per year during the war, but this has disappeared. When manufacture of concentrated phosphates by the use of electrical energy is taken up, the necessary quantity of phosphorus will become available easily. We do not, therefore, consider that by itself, manufacture of this small quantity of phosphorus justifies installing a plant.

(c) POTASH FERTILISERS.

76. Potassium may be used as a fertiliser in the form of chloride, sulphate, nitrate or carbonate or as organic potash. The raw material available in India in this respect is potassium nitrate, about 15,000 tons of which are, we understand, produced from large tracts of saline earth in Bihar, U.P., Punjab, Bikaner, Patiala and Bharatpur. Production can be increased, if necessary, without any difficulty. Cost of production is high, due probably to want of proper organisation and we recommend that this may be examined in consultation with the Provincial and State Governments.

VII. OTHER INORGANIC CHEMICALS.

Calcium Carbide.—This is considered in Part II para 10.

(a) Magnesia.

77. The most important use of magnesia is in the preparation of magnesia cements and in the manufacture of refractories. Imports have been about 500—600 tons. Recently, one of the firms in India has started production and since it is expected that the requirements will be met by local manufacture, no action is necessary.

(b) Arsenic Oxide.

78. The important civilian use of arsenic oxide is as an insecticide. Pre-war average imports were about 250 tons. We understand that Chitral State has deposits of arsenic ores but no supply has been possible due to want of proper communications. We suggest to the Government of India that they may approach the Chitral State authorities to improve communications to enable the chemical to be brought into India cheaply.

(c) **Borax.**

79. Borax is used in the manufacture of glass and ceramics, imports having been of the order of 1,500 tons. There has been no production in India so far, but we understand that there are borax resources in some parts of India and recommend that they must be exploited.

(d) **Dichromates and Chromic Acid.**

80. Sodium and potassium dichromates are extremely important chemicals used for khaki dyeing, in chrome tanning of leather and to a smaller extent in the production of chrome yellow primrose chrome, lemon chrome, middle chrome and orange chrome, chrome green and chrome red pigments required by the paint industry and for chemical bleaching of some oils and fats. Potassium dichromate is also used in the match industry. Chromic acid required for chromium plating in the electro-plating industry and for anodising aluminium and its alloys is also prepared from the dichromates.

81. This industry started and developed in India purely as a war measure has been assured of protection against unfair competition from abroad after the war. In spite of the fact that the raw materials: chrome ore, soda ash, lime and sulphuric acid are available in India, cost of production is even now high compared to the imported product. The annual maximum capacity is about 5,000 tons but production has been only about 3,500 tons. Annual imports, before the war were only of the order of 1,000 tons, but the demand during the war increased to nearly 6,000 tons. If all the plants continue to work, we fear there will be over-production in the post-war period, unless there is a very large increase in the chrome tanning industry and manufacture of khaki textiles. The industry is now controlled by Government both as regards price and distribution; but when this control is removed and an open market established, the industry may not be able to survive competition in the post-war period. We consider that this industry should be given encouragement by grant of protection. A list of dichromate factories with their annual capacities is given in Appendix VII.

Some dichromate and other factories are manufacturing small quantities of chromic acid, but the use of the acid on an appreciable scale has yet to be developed. Present production is about 25-50 tons.

VIII. OTHER ORGANIC SUBSTANCES & DERIVATIVES.

(i) **Alcohol.**

82. Alcohol is required for the manufacture of ether, chloroform, acetic acid, pharmaceutical preparations, perfumery, spirit varnishes and a host of other products. Next to water, it is the most important solvent. It is also used on an extensive scale in spirit lamps and stoves and for motor engines. Its wide-spread use as a beverage is well-known. Therefore it is seen that it is a very important chemical for chemical industries in addition to its other uses.

A number of distilleries have been in existence in India during many years, but the alcohol produced in them was used mostly for the preparation of alcoholic beverages. It was far too costly to be used in industries. During recent years, however, large distilleries with equipment for manufacturing power alcohol have been installed and there

are now five of them—two in the U.P. and one each in Bombay Presidency, Hyderabad and Mysore States. Their total maximum capacity is 2.5 million gallons of power alcohol per year, although their present production is only one million gallons. We understand that the Sugar Panel has fixed a target of 1.6 million tons of sugar per year and has come to the conclusion that when this production is reached 26 million gallons of alcohol can be produced from all the surplus molasses available. For chemical industries, only a fraction of this will be sufficient, but we have to emphasize that for the development of these industries it must be available at a very low price and free of duty, denatured with different denaturants suitable for use in the various chemical industries.

(ii) **Acetic Acid.**

83. The chief commercial uses of acetic acid are in the manufacture of white lead and rubber, of acetates particularly cellulose acetate and solvents. Indian consumption is about 400 ton per annum. The acid can be manufactured in a number of ways—by wood distillation, from ethyl alcohol or synthetically from calcium carbide. There is only one wood distillation plant in India which has enough raw material to produce 300 tons of acetic acid per annum if conditions are favourable. But, due to the high cost of wood it is unlikely that acetic acid produced by wood distillation can compete with the synthetic acid. Manufacture of power alcohol from molasses is likely to be taken up on a large scale all over the country and when the present abnormal conditions are over, the alcohol situation is likely to improve. We understand the Rayon Panel has recommended the manufacture of 10 tons of Acetate Rayon per day. This would require about 7,200 tons of acetic acid and of acetic anhydride each per year—equivalent in all to about 16,000 tons of acetic acid. We recommend that this manufacture be taken up starting from alcohol in distilleries. Without taking rayon into account, we estimate the demand to be about 600—700 tons per year. To meet this ordinary demand, no further steps are necessary as we understand that the Government of India have already granted an import licence for one plant of capacity 2 tons per day to one of the distilleries in the U.P.

(iii) **Lead Acetate.**

84. Imports of lead acetate have been about 80 tons per annum. We have not considered this subject as it more legitimately belongs to the Paints and Varnishes Panel and is being considered there.

(iv) **Sodium Acetate.**

85. Sodium acetate which is used in the textile industry is being manufactured in small quantities by a number of firms starting from acetate of lime obtained in the wood distillation industry. When manufacture of acetic acid is taken up, this salt could be more conveniently prepared from it. We do not consider any special steps necessary.

(v) **Glycerine.**

86. The chief uses of glycerine are in pharmacy (70%), explosives such as nitro-glycerine (18%) and in textiles etc. (12 per cent). Before the war, consumption in India was 850 tons; production in the soap industry was about 650—700 tons and nearly 100 tons used to be

imported. The present annual production is 2,500 tons; although this is more than sufficient for India's requirements, it is understood that there has developed recently great demand from the U.S.A. for glycerine from India and this demand is likely to last for some time. Whether any increased manufacture has to be permitted in view of this demand, may be examined by Government. We understand that the Government of India have given import licences for two more glycerine recovery plants, one to be installed in Kathiawar and the other in Calcutta. Considering the large number of soap factories working successfully in India, we are of the opinion that manufacture of glycerine which is obtained as a by-product in the soap industry can be increased without any difficulty, when larger quantities will be required for the manufacture of nitro-glycerine explosives for use in connection with post-war schemes, such as construction of dams, highways, etc.

(vi) **Methyl Alcohol and Formaldehyde.**

87. Apart from the use of formaldehyde for the preservation of specimens and as an antiseptic, its industrial importance lies in its being one of the most important raw materials for the manufacture of plastics and plastic glue necessary in plywood manufacture. The raw material is methyl alcohol from which it is produced in the Mysore Iron & Steel Works, to the extent of 60 tons per annum. We are of the opinion, however, that large scale manufacture of synthetic methyl alcohol should be taken up in the proposed ammonia plant at Sindhri, which will enable the required quantity of formaldehyde to be produced in India.

(vii) **Starch.**

88. Indian textile industry consumes about 20,000 tons of maize starch per annum. We understand that production in India now is sufficient, a number of firms having taken up manufacture. Starch is also the raw material for manufacture of glucose which, in addition to being an important medicinal product, will also be required in large quantities for the manufacture of confectionery and in the Viscose Rayon industry. Small quantities of glucose are manufactured at present. We understand that one complete plant for the manufacture of glucose (both liquid and solid) is likely to be installed in Calcutta and recommend that glucose manufacture from starch should be further developed to supply the requirements.

(viii) **Acetone.**

89. Acetone is an important solvent used for dissolving acetylene and varnishes and for the manufacture of cordite. The Indian Oxygen and Acetylene Company uses about 7,000 gallons of acetone for dissolved acetylene, but all this is not consumed, only evaporation losses being replenished. Government plant at Aruvankadu has a capacity of 1,000 tons per annum for manufacture from alcohol. We understand that an import licence for an acetone plant of 300 tons annual capacity starting from alcohol has been granted, the plant to be installed in the U. P. Civilian demand is at present very small, but with the development of the paint, lacquer and acetate rayon industries, much larger quantities would be required. For the manufacture of 10 tons of acetate rayon per day as recommended by the Rayon Panel, 12,000 tons of acetone will be required per year, but all of it will not

be consumed and most of it can be recovered. We understand that demand from the War Department is reduced and production is considerably curtailed in the Government Ordnance Factories. We, therefore, recommend that Government production be released for civilian uses and for additional quantities, manufacture from alcohol be started. We also recommend that production of acetone by fermentation of molasses should be taken up, as it would give butanol, a useful solvent for the paint industry, as a by-product.

IX. INDUSTRIAL GASES.

(i) Oxygen.

90. Oxygen may be made either from liquid air or by the electrolysis of water, both processes being in use. It is obtained as a by-product in many of the hydrogenation factories where hydrogen is manufactured by electrolysis of water for hydrogenation of oils and also in the ammonia factory at Belagula, and is collected in many of these factories. It is usually compressed into cylinders and sold as such for oxy-acetylene welding. Production in 1937 was 22 million cft., which increased in 1942 to nearly 53 million cft. and is probably more now. In this connection, we recommend that transport charges for oxygen should be reduced, the weight of cylinders being more than that of the gas.

(ii) Hydrogen.

91. We have not considered hydrogen as its chief use now is for hydrogenation of oils and would be dealt with by the Food Department.

(iii) Carbon Dioxide.

92. Carbon dioxide is obtained as a by-product in the fermentation industry and is being collected in a few of the factories; it is largely used for the manufacture of aerated waters, in fire-extinguishers and also as a refrigerant in the form of dry ice, use of which unfortunately has not been developed in India, especially for preservation of food-stuffs. It would also be required for the manufacture of urea and soda ash, when these are developed, but for these, it would be prepared in the factories themselves.

X. COAL TAR PRODUCTS.

93. Of coal tar products, we have considered only naphthalene, creosote, phenol and cresylic acid under the category of Heavy Chemicals. There are nine tar producing and five tar distillation plants in India (Appendix VIII), average annual production of the four chemicals mentioned above on the basis of the present working of the tar distillation plants being as follows:—

25 tons of phenol.

60 tons of cresylic acid (commercial).

600 tons of naphthalene

500,000 gallons of heavy creosote oil.

We understand, however, that production at present is much less, only 3,000 gallons of tar being available per month for distillation, while

before the war, out of 7,000 tons of coal tar manufactured per month, 5,000 tons were being distilled. We understand that the total annual output of benzol is 2.4 million gallons from which 1.2 million gallons of pure benzene can be obtained; benzol is being used now as liquid fuel in admixture with petrol. We are of the opinion that cheap benzene is essential and should have the benefit of a reduced duty. We consider that production of all these chemicals has to be increased, but as a special Indian Coalfields' Committee has been appointed, we have not examined this question in any detail, at this stage.

XI. MISCELLANEOUS.

94. We have not also considered the manufacture of dyestuffs as the question had been referred to the Dyestuffs Exploratory Committee of the Board of Scientific and Industrial Research, whose report has since been published. We understand that an industry is now being started by an Indian concern in association with a British firm. For the same reason, chemicals such as phosphorous chlorides, sulphur chlorides, chlorosulphonic acid etc., which are required for the manufacture of dyestuffs are not referred to in this report.

95. We understand that in many countries which do not possess mineral oil resources, crude petroleum is imported and industries have been established for cracking and refining it. This has enabled many chemical industries to be developed in those countries. Indian resources of mineral oils are not plentiful and we recommend that Government of India should give facilities for importing crude petroleum and for the installation of plants for cracking and refining it. This would be a very desirable industry in India.

96. Although reliable figures are not available regarding the consumption of explosives for civilian purposes, the quantity is considerable. Except for the manufacture of explosives in the Ordnance factories, there is no manufacture of modern explosives in India. In future India, we estimate that very large quantities of explosives will be required in the Post-war schemes such as highway and dam construction, development of mining industries etc. We, therefore, recommend that manufacture of explosives for civilian purposes should be taken up by the Government of India very early.

PART II.

ELECTRO-CHEMICAL INDUSTRIES.

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ELECTRO-CHEMICAL INDUSTRIES.

In addition to the extensive use of electricity in modern chemical plant for driving machinery, for lighting, recorders, communication, signals and temperature control, there are applications where electrical energy is directly responsible for chemical decompositions resulting in production of useful substances and in other cases, for supplying heat through the agency of which chemical reactions are brought about. Although electro-chemical industries are of comparatively recent origin, electricity has proved to be a most valuable tool in the hands of the chemical engineer and has not only revolutionised older methods of chemical manufacture, but has also been responsible for altogether new industries.

Electro-Chemical Vs. Chemical Processes.

2. In the former category, the older purely chemical have to compete against the newer electro-chemical processes. Lime-soda caustic is still competing successfully against electrolytic caustic soda. Hydrogen is being manufactured both from electrolytic cell and by the watergas method. Electrolytic zinc has not completely displaced spelter from the older retort processes. In many cases, however, the older methods have been completely supplanted. Where the older processes have survived, it is generally due to some special circumstances such as availability of cheap raw materials, non-availability of cheap electricity or hesitation of the owners of older plants to scrap them and change over.

3. The electric furnace and electrolytic cell have been responsible for entirely new industries. Aluminium, magnesium, carbide and artificial abrasives might not have become commercial products except for the electric furnace. Electrolytic caustic soda has given so much cheap chlorine, that new uses have been found for it and many of the outlets would never have been possible except for the cheapness of the gas. Synthetic chemical industry has benefitted enormously by the production of metallic sodium in electrolytic cell at less than a tenth of the cost by the older method.

Classification.

4. Electro-chemical industries are based on electrolytic and electro-thermal processes or a combination of both. In the electrolytic process, electrical energy is entirely responsible for the chemical reaction. In the electro-thermal, it is used only as a thermal agent, after having been converted into heat; extremely high temperatures can be attained in a very clean way by this means. The former requires direct current; for electro-thermal industries, either direct or alternating current may be used, preferably the latter.

Importance of Cost of Power.

5. In many of these industries, electrical energy forms the major protion of the cost of the product, success or otherwise of the industry being largely dependent on the rate at which power is made available to the industry. In such cases, the industry has to be located very near the site of power generation, as for example, in the case of aluminium, magnesium, carbide, ferro-alloys and abrasives. In some industies, e.g., electro-plating, manufacture of storage batteries, organic chemicals etc., however, cost of energy may form only a minor portion

of the total cost, and in those cases, other considerations may prevail to determine the location. Individual cases have to be decided on their own merits, taking all factors into account. In view of the importance of electrical power for these industries, we are of the opinion that cheap and abundant power is essential for them.

Development in Other Countries.

6. The greatest developments in electro-chemical industries have taken place mostly in Norway where electrical power is available at extremely low rates and in the U.S.A. and Canada also. Price of electrical energy supplied to electro-chemical industries in different parts of the world compared with rates in India is given in Appendix IX. As regards the power consumed in these industries, in the U.S.A., we find from published data that in 1939, 73×10^9 KWH were consumed in industries of which chemicals alone consumed 9×10^9 KWH being second only to iron and steel and paper industries; but in 1944, 32×10^9 KWH were consumed by chemical industries—the highest in a total consumption of 168×10^9 KWH by all industries. The consumption by chemicals was not all for electro-chemical industries only. Table I gives a fair idea of analysis of consumption of electrical energy in the U.S.A. by different industries just before the recent war and in a typical war year.

Almost no Development in India.

7. In India, there has been very little development except for one or two areas. We anticipate, however, that with the completion of the hydro-electric projects now being planned, abundant power will become available and it will be possible to establish many electro-chemical industries. Capacity and location of the existing electric power stations, as also of new stations planned, are given in Appendix X.

8. A comprehensive list of electro-chemical industries is given in Appendix XI. Cost of power related to the price of product in the U.S.A. is indicated in Appendix XII.

TABLE I.

Industry group.	Thousands of Kilowatt-hours.	
	1939	1944
MANUFACTURING INDUSTRIES—		
Chemicals	9,356,998	31,859,753
Non-ferrous metals	6,085,358	28,901,486
Iron and steel	12,781,648	25,192,502
Paper	9,462,556	11,980,422
Textiles	6,272,654	9,278,018
Transportation equipment	493,310	8,071,418
Stone, clay and glass	4,503,209	5,978,131
Food	4,521,733	5,753,495
Machinery, except electrical	1,805,704	5,672,008
Automobiles	2,432,205	4,590,838
Electrical machinery	1,392,951	3,747,589
Rubber	1,557,227	2,034,946
Lumber	1,132,235	1,525,728
Miscellaneous	339,803	810,939
Furniture	412,043	604,609
Leather	294,516	373,409
Printing	289,933	346,165
Tobacco	81,255	108,432
Apparel	72,585	102,673
All manufacturing	66,399,859	152,902,999
EXTRACTING INDUSTRIES—		
Coal mining	3,035,015	4,617,680
Metal mining	1,993,912	3,234,810
Non-metallic mining	536,477	805,994
Petroleum and natural gas	549,001	619,050
All extracting	6,114,405	9,277,534
Government	609,688	5,983,123
All industries	73,123,952	168,163,656

I. ELECTROLYTIC PROCESSES.

Caustic Soda, Caustic Potash, and Chlorine; Potassium Chlorate.—These have been considered in Part I, paras 39-53.

Oxygen and Hydrogen.—These have been considered in Part I, paras 90-91.

Hydrogen Peroxide.

9. We understand that hydrogen peroxide is fast becoming a serious competitor to chlorine for purposes of bleaching and is often preferred in some cases, because it leaves no harmful traces. In India, its use has not been developed to any extent. If commercial production is started, there may be good demand in the manufacture of superior class of fabrics. We understand that the Government of India have granted an import licence for a plant of 350-400 capacity per year to be installed in Bombay. More plants may be permitted to be installed in textile centres where there is a definite demand. Reference may be made to the new anthraquinone autoxidation process for the production of hydrogen peroxide which basically consists of the union of hydrogen and oxygen to form hydrogen peroxide, 2-ethyl anthraquinone acting as a carrier for hydrogen. Nickle-aluminium and silver-nickel catalysts are used and the 20 per cent solution of hydrogen peroxide obtained has to be subjected to two distillations for raising the strength to 85 per cent. The process may be presumed to be satisfactory as the Germans had planned to instal two very large factories, each of them of capacity to produce 24,000 tons of hydrogen peroxide, 85 per cent. strength per year. Whether this new process which has been patented, is of direct interest to India for the present is doubtful since apart from the special catalysts, 2-ethyl anthroquinone, very highly purified benzene and a mixture of secondary alcohols (C7 to C11) are necessary.

II. ELECTRO-THERMAL PROCESSES.

Phosphates.—These have been considered in Part I, paras 73-75.

Calcium Carbide.

10. The chief applications of calcium carbide are in the manufacture of calcium cyanamide fertiliser, of acetylene required in oxy-acetylene welding and in chemical synthesis of a variety of organic compounds used as medicines, dyestuffs, solvents and for the manufacture of synthetic rubber. Calcium carbide is produced only in the electric furnace, a large block of power being required for its manufacture. Electric furnaces used are of the submerged arc type. Heat is produced by short arcs taking place between the electrodes, the crushed materials closely surrounding them. Power consumption is about 3,500 KWH per ton in the modern furnace. Electrode consumption is also heavy, forming about a sixth of the cost of the product. Production in the U.S.A. before the war was about 150,000 tons, electric power consumed being nearly 500 million KWH. Pre-war average imports into India of carbide were about 3,500 tons per annum most of it for the production of acetylene gas; during the war, demand was, however, about 7,000 tons, including war requirements. In the absence of chemical industries depending on calcium carbide,

we do not think that future requirements are likely to exceed this figure in the first-five-year-period and we recommended 7,000 tons as the target. We understand the Government of India have granted an import licence for a 5,000 ton plant to be installed in Bihar. For the balance of 2,000—2,500 tons, we recommended that a plant may be put up in South India where electric power is available immediately, as in the Jog area. It is understood that the necessary equipment which is already available in Mysore is being used now for manufacture of ferro-silicon, but that shortly, it is proposed to instal a larger unit for the latter, when the existing equipment can be utilised for manufacture of carbide.

(b) Calcium Cyanamide.

11. Calcium cyanamide is obtained by passing purified nitrogen obtained from air over calcium carbide maintained at a temperature of 2,000F. Its use as a fertiliser has not been established in India and there seems to be no urgency to take up this question in preference to other nitrogenous fertilisers, as it is understood that its use as a fertiliser is declining in other countries. Its manufacture could be considered, if necessary, when the carbide industry is well established in India.

Ammonia.—This has been considered in Part I, paras 63-65.

(c) Carbon Disulphide.

12. Carbon disulphide is an important chemical required in the manufacture of rayon by the Viscose process. For each ton of rayon, 0.4 ton of disulphide is necessary; the Rayon Panel have, we understand, fixed a target of 60 tons of viscose rayon per day, which would require about 8,760 tons of disulphide per year. We consider, however, that the chemical should be prepared in the rayon factories themselves in suitable units. Large quantities of carbon disulphide would also be required for the manufacture of carbon tetrachloride required in the oil industry as a solvent in the solvent extraction process. We are not able to arrive at a decision as regards the quantity required in the absence of the recommendations of the Soaps and Oils Panel. Carbon disulphide is made from sulphur and charcoal in the electric furnace which is found to be more convenient and durable, although the reaction takes place at a comparatively low temperature.

(d) Artificial Abrasives.

13. The enormous increase in the use of artificial abrasives in recent years, has made possible the grinding and polishing of high-alloy steels and high speed precision grinding. India has taken up the manufacture mostly of coated abrasives, abrasive papers and cloth only. Annual imports are of the value of about Rs. 10 lakhs while the value of indigenous production is about Rs. 5 lakhs. Precision grinding wheels are also being fabricated by one or two firms, most of the abraisive grains being imported. Garnet sands are found in the Tinnevelly District of Madras, Jaipur and a few other Indian States. We understand that Indian emery is not suitable and hence Turkish emery has to be imported. Natural corruudum is found in many parts of India, but no organised production seems to have been taken up. We recommend that the question of utilisation of all these should be carefully examined.

14. Artificial abrasives are manufactured only by electro-thermal methods in the furnace. Carborundum and a few other carbides, and fused alumina are of importance. There is no manufacture of these in India at present, but in any scheme of development of electro-chemical industries, they must find a place, especially as the raw materials are all easily available and cheap electrical energy may be expected to become available shortly.

Silicon Carbide (Carborundum).

15. Silicon carbide is made by heating silica sand and excess of carbon to a high temperature. A ton of silicon carbide requires about 9,000-10,500 KWH for its manufacture. It is extremely hard and possesses excellent cutting properties, but we understand that because of its brittleness it cannot be used for grinding wheels of high tensile strength and does not therefore form a satisfactory substitute for natural emery.

Fused Alumina (Corundum).

16. Fused alumina is a very important abrasive and has, we understand, largely replaced natural emery. Calcined bauxite is mixed with carbon, sufficient to reduce the impurities to the metallic condition, but insufficient to react with alumina. The starting materials have to be chosen very carefully in order to make a satisfactory product. Electrical energy consumed is 2,600-3,200 KWH per ton.

Boron Carbide.

17. Boron Carbide made from boron oxide and carbon in the electric furnace is one of new abrasives recently come into prominence and has been claimed to be the " hardest material ever made by man."

18. There is no manufacture of artificial abrasive grains in India, as already stated. Information as to how much of these are imported is not really available. The manufacturers of coated abrasives are small establishments scattered all over the country and in these circumstances, it is difficult to collect any data as regards the demand for these. We recommend, however, that to begin with, furnaces with a capacity of 2,000 tons for each of these abrasives may be installed near a source of power. We understand that some firms who have already established the manufacture of bonded abrasives successfully are desirous of preparing the grains also, provided some concessions such as cheap power etc., are given. We are of the opinion that they should be encouraged. Since this is such an important industry, we are of the opinion that the manufacture of grains should be developed on cheap seasonal power, and further, as some firms have demonstrated that they can manufacture bonded and coated abrasives successfully Government should give them very cheap power and other concessions to develop this industry.

(e) Artificial Graphite.

19. Pure carbon cannot be transformed into graphite merely by heating, but it must pass through the stage of a carbide. Anthracite, petroleum coke or any other carbon carrying enough ash matter can be used for the furnace charge, the ash furnishing the metallic portion necessary. For manufacture of electrodes, the powder is moulded first into shape with the use of tar or pitch binders and then

graphitised. If only graphite powder is required, the carbon powder itself is used in the furnace. Power consumption is highly variable depending on the size and condition of the charged materials, the required degree of baking or graphitising etc. We understand that the average is about 3,600—9,000 KWH per ton of product.

20. All electro-chemical industries require electrodes—graphite or carbon, which are continuously consumed. Those which deliver energy to the electric furnaces and many of the eletrolytic cells are massive rods or plates of carbon or graphite and are themselves manufactured in the electric furnace. Although many types of carbonaceous matter were used as starting substances in the beginning only two are chiefly used now, low ash coals with very little volatile matter and petroleum coke. They are first freed of their volatile matter by heating to a white heat and then ground to a fine powder in special machines. Mixed with the binding material—coal tar or pitch, in steam-jacketed mixers, the hot plastic mass is made to pass through extrusion presses to give the required dimension and shape, and then cooled under a spray of cold water when it becomes comparatively stiff. These are called 'green' electrodes. The first baking is done in furnaces at a temperature of not more than 1,100°C. During this process, the binder is carbonised and freed of all volatile matter. The electrodes are then gradually cooled. A second baking is done in electric furnaces (4,100°C) for graphite electrodes or in gas-fired furnaces for carbon electrodes, as the case may be. The importance of electrodes in electro-chemical industries can be seen from the fact that they are essential for the manufacture of electric steel, ferro-alloys, calcium carbide, aluminium, magnesium, electrolytic caustic, phosphorus etc. Table II gives an indication of electrode consumption in some of these.

TABLE II.

Product.	Pounds per ton of product.	
	Carbon.	Graphite.
Non-ferrous castings	...	2·8—11
Iron castings cold scrap	...	5·6—11
Iron castings, duplex	...	3·4—15·5
Electrolytic Chlorine	...	7
Steel casting	10—22	...
Steel ingots	16—33	...
Calcium carbide	33—220	...
Aluminium	1700--2250	...
Ferro-silicon (15%)	25—50	...
Ferro-silicon (50%)	50—75	...
Ferro-silicon (80%)	80—120	...
High-silicon (ferro-silicon)	150—300	...

Although electrodes are being used in many factories no data are available for the consumption of electrodes in India at present. The demand will increase with the development of electro-chemical industries. We understand that a company has been started in Travancore, with a capital of Rs. 25 lakhs to manufacture carbon and grapihte materials required for electro-chemical industries. We consider manufacture of electrodes of the utmost importance for all electro-chemical development and are of the opinion that Government of India should itself instal one or two plants, if manufacture does not materialise within a reasonable length of time in the factory planned in Travancore. We recommend in this connection that in order to save freight charges, petroleum coke should be supplied to the electrode plants only after first calcination has been carried out in the oil refinery itself

III.—ELECTRO-METALLURGY OF METALS.

(a) Iron & Steel.—

21. In place of coke or charcoal, the use of electricity as a thermal agent for the smelting of iron and steel will be of special value in places where fuel is expensive and not easily available, electrical supply being cheap and plentiful. Power consumption per ton of pig iron produced is 2,800 KWH. Application of electrical energy does not eliminate the use of coke or charcoal altogether but the quantity is curtailed to a third, the function of the carbon becoming only that of a reducing agent. We understand that the electro-metallurgical process is in use in Norway and Sweden (in Italy and Japan before the war). In India, where metallurgical coal resources are not plentiful and large scale hydro-electric developments are being planned, electro-metallurgical processes will be valuable especially in those areas where there is no adequate coal or charcoal supply and electric power is available. Mysore Iron & Steel Works are planning to instal electric blast furnaces, in order to save charcoal which is expensive and in short supply. For manufacture of special steels which are obtained by methods of refining and alloying involving high temperatures and accurate process control, the electric furnace possesses special advantages. Such furnaces are working in India in many places.

We have not considered this subject in our report in any detail, as it belongs, more legitimately to the Iron & Steel Panel.

(b) Ferro-Alloys.

22. Alloys steels require the use of small quantities of ferro-alloys for their manufacture. These ferro-alloys which are electric furnace products contain more of the other metal constituent than of iron. In small proportions, some of these non-ferrous elements are responsible for the removal of impurities from iron, while in larger proportions, they enter into combination and give rise to special steels. Ferro-alloys are produced in electric furnaces of the submerged arc type.

Ferro-Manganese.

23. Ferro-manganese is now manufactured in the blast furnace at Jamshedpur as for ordinary grades (40—70 per cent. manganese) electric furnace is not considered more advantageous. For higher

grades containing 80 per cent. manganese, however, we understand, that the electrical process is more satisfactory. The raw materials are manganese ore and carbon, and power consumption is about 4,500—5,000 KWH for product containing 75 per cent. manganese and 6,700—7,850 KWH per ton for 80 per cent. ferro-manganese. We are informed that excellent manganese ore and iron ore of good quality are available in the Sandur State and it is probable that electric power also will become available shortly. We recommend, therefore, that this area may be considered as suitable for manufacture of ferro-manganese in large quantities and also later, steel of good quality.

Ferro-Silicon.

24 The raw materials are quartz, iron scrap and charcoal. There are no technical difficulties and 70 per cent. grade is usually manufactured. The energy consumption for 50 per cent. ferro-silicon is 5,500—6,750 KWH per ton, for 75 per cent. product 10,000—12,000 KWH per ton, and for 90 per cent. alloy 15,000 KWH per ton. The total Indian demand is estimated at about 4,000 tons, but may be expected to go up to 10,000 tons in five years. We understand that Mysore is manufacturing ferro-silicon with two small 1,500 KVA furnaces of 1,000 tons capacity each per annum and supplying it to all the Iron and Steel manufactures in India and that it is proposed to increase production to 4,000 tons or more if necessary in the Jog area. No further action seems to be necessary.

Ferro-Chromium.

25. Anticipated demand in India is about 3,000 tons. The raw materials are chromite ore and charcoal or coke. This ferro-alloy is essential for production of stainless steel and 60 per cent. grade is usually used. The power requirements are about 12,000 KWH per ton of low carbon alloy and 6,000—7,000 KWH per ton of high carbon alloy. We understand that one of the Mysore furnaces was earmarked for ferro-chrome, but since more ferro-silicon was required during the war, this could not be taken up. Chrome ore is available in plenty, but most of it is of poor quality and would require beneficiation to render it suitable. Development of ferro-chrome which is linked with the manufacture of stainless and other chromium steels can be taken up when the programme of development of the Steel Industry is decided.

(c) Aluminium.

26. Aluminia dissolved in a molten bath of the double flouride of aluminium and sodium (cryolite) to which some calcium flouride (fluorspar) is added, is electrolysed to extract this important metal. It occurs generally in the mineral bauxite to the extent of 50—60 per cent. as alumina. Indian resources of bauxite are enormous, the reserves of the better grade being estimated roughly at 250 million tons, proved workable deposits being those of Jubbulpore and Balaghat districts of the Ranchi plateau in Bihar and the Shevaroy hills of the Salem District and small occurences in Mysore, Central India, etc. With such large resources, India should hold a leading position in the world, but very little progress has been possible for want of very cheap power which is essential and is the determining factor. Although Canada possesses none of the raw materials with the possible exception of fluorspar, it imports bauxite from British Guiana and

with the advantage of cheap hydro-electric power, it has developed the largest aluminium producing centre in the world.

27. The raw materials for the production of aluminium (per lb.) are:—

TABLE III

Electric power	10 KWH.
Bauxite	4 lbs.
Caustic soda	0-15 lb.
Cryolite	0-05 lb.
Aluminium	0-03 lb.
Fluorspar	0-01 lb.
Petroleum coke	0-65 lb.
Pitch	0-07 lb.
Coal	3-50 lbs.

The quantity of caustic soda required is quite small and can easily be supplied from local manufacturers. Natural cryolite and aluminium fluoride have to be imported, the former from the only source, Greenland. Fluorspar although available in India, is not, we understand, upto the purity required and it may not prove profitable to introduce special purification methods in view of the small quantities required. Petroleum coke and pitch are required for the manufacture of electrodes; the former is available at the oil refineries at Digboi and the latter can be obtained from the coke ovens in Bengal and Bihar. High cost of transport and want of cheap electric power are impeding the development of this industry in India. We are informed that it is cheaper to ship bauxite from South America to a factory in Northern Canada than it is to transport it from the C.P. to a factory in Bihar. Bauxite itself costs little, but the transport charges are much higher. A factory on the West Coast of India can get petroleum coke cheaper from the U.S.A. than from Digboi.

28. U.S.A. consumes 2 lbs. of aluminium per head per annum, U.K. 1 lb., but India less than 0.025 lb. There was no production in India before the war, imports being on the average about 4,000 tons per year. Most of this quantity was used for manufacture of utensils, industrial uses having been negligible. There are now two firms manufacturing aluminium, one in Travancore and the other in Bengal. The total productive capacity is about 15,000 tons of alumina and about 7,500 tons of aluminium per year with provision for developing it to 10,000 tons.

29. It is difficult to foresee the demand in future industrial India. With the development of the engineering industries, estimates have been put up as high as 20,000 tons, which may not be improbable considering the large developments—electrical, mechanical and chemical, planned. As regards demand for utensils, even if we plan on the basis of one plate and one tumbler per head for a half of India's population, the demand for aluminium will be very large. Since Indian resources of copper and zinc are very scanty, we are of the opinion that aluminium should be utilised in a greater degree for utensils. We understand that if metal of sufficient purity is used, the utensils are not corroded by highly spiced food. Transport services

could consume the metal in large quantities. Taking all these into consideration we recommend that production should be raised to 15,000 tons per annum immediately, with provision for 20,000 tons later. Government of India are therefore, requested to arrange for another aluminium plant of 5,000 tons immediate capacity ultimately to be raised to 8,000—10,000 tons near a source of power supply. We are of opinion that this industry requires special treatment for the next five years or a shorter period if power situation improves after which it may be expected to stand competition if railway concessions comparable to Canadian and U.S.A. rates are given and the present tariff rates continued. In this connection, it is of interest to compare the freight rates in Canada and India (Table IV). In order to safeguard the fabrication industries, we suggest that during the interim period, they also should be protected, if they are not able to get the metal at the same rate as the imported material. We, therefore, recommend a suitable subsidy to this industry, based on a periodical examination of costs.

TABLE IV.

Rates per Ton—Milc.

Commodity.	Canadian Dollars		Rupees.	
	India.	Canada.	India.	Canada.
Aluminium Ingot ...	·0180	·0050	0 0 11	0 0 2·9
Aluminium sheets and circles...	·0090	·0060	0 0 5·5	0 0 3·5
Bauxite	·0205	·0160	0 1 0	0 0 9·3
Alumina	·0227	·0068	0 1 1	0 0 4·0
Petroleum coke*	·0060	·0050	0 0 4	0 0 2·9
Pitch	·0158	·0080	0 0 9	0 0 4·6

*This is the rate in India chargeable as Coke. However, it is now proposed to classify this material, used for electrodes, as carbon black, which will result in this rate being practically doubled.

(d) Magnesium.

30. This metal is one-third lighter than aluminium with most of the latter's desirable properties, its value being in alloys, the most important of which carries about 95 per cent. magnesium and 5 per cent. of other constituents like aluminium chromium manganese and antimony. Such alloys are specially strong and rigid in the different fabricated forms and have found extensive use in the manufacture of aircraft and other light structural products. The only difficulty seems to be in imparting corrosion resistance to them. Magnesium is used also in incendiary explosives. In the U.S.A. the present rated output of all the magnesium plants is about 260,000 tons, although the highest production in any one year has so far been only 165,000 tons. The rated output is manufactured by different processes in the following proportions: electrolytic 72.4 per cent., ferro-silicon 23.5 per cent. and carbon 4.1 per cent. For the electrolytic process, magnesium chloride is the raw material, calcined dolomite and ferro-silicon for

the ferro-silicon process, and magnesia for the carbon process. Magnesium industry consumed in 1939 nearly 72×10^6 KWH which increased to $6,000 \times 10^6$ in 1944. This gives some idea of the enormous development of the industry in the U.S.A. during the war.

31. Only the two standard processes, electrolytic and the more recent ferro-silicon need to be considered for our purposes. In the first, anhydrous magnesium chloride is the electrolyte, the equipment used being very much the same as for aluminium. Consumption of power is about 29,000 KWH per ton. In the ferro-silicon process as developed by Pidgeon, magnesia of calcined dolomite is reduced by means of ferro-silicon at a temperature of about 1160°C, the necessary condition being that the reaction is carried out in a vessel with a very high vacuum 0.05 mm. Appendix XIII gives some details of the process worked in one of the magnesium plants in Canada. Ferro-silicon process is stated to give a metal of higher purity, the capital cost being only a third of the electrolytic process. Power consumption including that for ferro-silicon is about 21,700 KWH per ton.

32. In India, there has been no manufacture so far although the raw materials for either process are available, but unless aircraft and automobile production resulting in demand for special alloys develops, we are not able to see any immediate use for magnesium. Both developments must be taken up *pari pasu*. In view of the importance of the metal, we recommend that a small plant producing 3-5 tons a day by the Pidgeon Process may be put up by Government as a measure of national importance, although capital cost may be high for such a small plant. It is understood that magnesium is available at a low price in U.S.A. and Canada. In order to create a market for the metal and to encourage the manufacture of its alloys, we recommend that Government of India should purchase and stock 1,000 tons of this metal and make it available to Indian manufacturers at cost price.

(e) Copper.

33. Copper pyrites containing 34.5 per cent. copper, 30.5 per cent. iron and 35 per cent. sulphur is the principal copper mineral and is fairly widely met with in India. The metal seems to have been manufactured in the old days as evidenced by the enormous heaps of slag in Jaipur State, in Bihar, in Sikkim, Pataila, Madras, Alwar, Rewa and other areas in the Himalayas and to a small extent in Mysore State. India's consumption of copper and its alloys in 1943 was estimated to be 72,400 tons and if Ordnance Factories requirements of 21,500 tons are not taken into account the demand works out to about 50,000 tons. Exclusive of brass and bronze, 10,000 tons of copper used to be imported before the war. Only one mining concern produces now about 6,000 tons of refined copper annually by treating roughly about 340,000 tons of the ore, containing only about 2.5 per cent. copper. Electric refining is not practised and the copper which is produced is inferior to the imported product from Africa and the U.S.A. This firm manufactures brass sheets which stand foreign competition successfully, but all electrolytic copper has to be imported. The Non-ferrous Metal Industries Panel have estimated the average annual consumption of copper during the next five years at:

Copper for copper base alloys	...	25,000—30,000 tons
Electrolytic copper ...	...	16,000—20,000 tons

Indian resources of copper ores, as at present known, are slender and are not sufficient for the manufacture of these large quantities of the metal. We recommend that for the present attempts must be made to produce 10,000 tons annually. Reference has been made in this report.

Part 1, para 11(iii) to the possibility of importing copper pyrites from Spain and manufacturing both copper and sulphuric acid. If this be found possible, we recommend that the target for electrolytic copper may be raised to 16,000 tons.

34. Copper industry has to be developed in two directions (1) production of electrolytic copper and (2) increase of production. For increase of production, the opinion of geologists is that the ores are widely distributed and there is no concentration of the pyrites in workable loads, veins or masses so that as at present known, the resources of India in these materials may be considered small. In other countries, ores containing 1—2 per cent copper are being used to extract the metal and it should be possible even in India to utilise the poorer grades of ore to obtain this important metal. At present the only proved deposits in Ghatsila are being worked. We recommend that the deposits in Jaipur, Sikkim, Khetri and Darjeeling also should be examined. Utilisation of scarp seems to possess great possibilities. We understand that in Germany, many primary metals used to be recovered in considerable quantities by electro-chemical separation from about 250,000 tons of scarp annually. We recommend that this be followed in India also, both locally available and imported scrap being utilised, which could be done if the industry is located near the sea ports. We are of the opinion that for this purpose, scrap should be permitted to be imported free of duty. We understand that 5,000-ton units would be economical, zinc or zinc oxide, tin, antimony and lead (sometimes gold and silver also), all being recovered by this method and we recommend that one unit with capacity to deal with 5,000 tons of scrap be installed at one of the sea port towns where power is available.

35. In order to conserve the scanty Indian resources of copper, we consider it desirable to utilise all scrap copper and refine it making it suitable for use in industry. The possibility of using low grade copper ores for the purpose of making copper salts would have to be examined.

IV. ELECTRO-PLATING.

36. Although no data are available, there is a very large number of small establishments all over the country carrying out refining of metals and electro-plating of small articles. This industry has attained great importance as very valuable and durable articles can be manufactured by coating on a cheap metal a thin layer of a valuable one. This is a very important industry and of great importance to the country. We, therefore, recommend that larger units to deal with industrial equipment should be installed.

V. GENERAL.

(a) Storage Batteries.

37. Electric accumulators are becoming increasingly important in India, with increase in the standard of living of the people. Apart

from their essential use in automobiles and railways, they also find extensive application for radio receivers in those places where there is no electric power supply and to a small extent, as the usual emergency sets in power stations, hospitals, picture houses, etc., the safeguard emergency essential lights in the event of a breakdown of the main supply. Before the war, most of the batteries required used to be imported. No definite data seem to be available as regards the number of batteries required, manufactured and imported annually. Both Dr. Thomas' report and Sea-borne Trade statements give 7—8 lakhs of rupees as the value of pre-war annual imports exclusive of the standard equipment of batteries in cars and other vehicles. The D.G.M.P. also agrees with this figure and estimates about 22,000—25,000 batteries used to be imported annually as standard equipment. If the price of battery, ex-duty is assumed to be about Rs. 16—20/-. Rs. 8 lakhs would correspond to about 40,000—50,000 batteries. Both the items together make up about 75,000. Some manufacturers have estimated the consumption figure to be very much higher. We consider that 100,000—125,000 batteries per annum would be a fair estimate of the requirement during the next five years. Most of the raw materials are available in India and even before the war, one or two firms were producing acid accumulators in India. Now there are five firms in all, specialising in manufacture of batteries and with assistance they received from Government such as supply of raw material etc., they did valuable service during the war. There will be keen competition hereafter from foreign sources and we are of the opinion that this important industry can thrive successfully if reasonable protection is given.

We understand that appreciable quantities of alkaline cells are purchased and used by Indian Railways. We are of the opinion that attempts must be made to manufacture them also in India itself.

(b) Dry Cells.

38. Dry cells are extremely convenient and handy sources of electrical energy and have deservedly become immensely popular. Manufacture has been by millions all over the world and their chief uses are in the radio, flash-light, ignition and signal systems. There are different sizes and shapes to suit every type of requirement. The raw materlais are manganese dioxide, carbon rod, graphite, ammonium and other chlorides, soot, lamp-black, wheat flour, starch and containers. The dolly materials are manganese dioxide (natural and artificial) as depolariser, graphite (natural and artificial) as electrical conductor, carbon rod as electrode and soot and lamp-black as porosity agents. Electrolyte materials consist of ammonium, zinc, calcium, magnesium and mercury chlorides of high purity and wheat flour and starch as gelatinising agents. Containers, caps and connecting strips are made from zinc and brass sheets. Soldier flux, sealing compound, wrapping cloth and card-board are the other accessories.

39. Before the war, India used to import about 25 lakhs of rupees worth of dry cells and batteries, 60—70 per cent. from the U.S.A., 10—12 per cent. from Germany 15—20 per cent. from the British Empire and small quantities from China and Japan. Indian industry has steadily grown and now there are about ten firms. Unfortunately, most of the raw materials valued at about Rs. 10 lakhs (pre-war) are imported even now; although they are available in

India, their quality is not quite suitable. We understand that as a result of investigations carried out by the Council of Scientific and Industrial Research, many of them can be used now after processing. Many Indian firms are using only manually operated or semi-automatic machines which have the advantage of lower initial investment and permit greater flexibility, but rate of production is lower. Before the war, competition from the U.S.A., Germany, China and Japan was very keen; cells from China and Japan were not good, but extremely cheap. We are informed that many Indian concerns are planning to increase their output by installing automatic machinery, zinc rolling mills and carbon electrode plants. We feel, however, that they should also use indigenous chemicals, after some processing if necessary. We understand that dry cells used to be manufactured in Japan on a cottage industry basis. This can be adopted in India also with advantage. A good beginning has been made in the dry cell industry and we are of the opinion that it should be developed further. In order to safeguard its future, we recommend that this industry should be given protection aginast foreign competition.

VI. ORGANIC CHEMICALS.

40. Reduction and oxidation of organic compounds have been carried out commercially in other countries through the agency of electrical energy. The important chemicals—anthraquinone from anthracene, chloroform from sodium chloride and acetone, iodoform from potassium iodide and alcohol or acetone, calcium gluconate, sorbitol and mannitol from glucose, para-aminophenol and benzidine from nitro-benzene are being manufactured in this way. Methods are fairly well known, but in some cases, technical difficulties have to be solved. Calcium gluconate is being manufactured on a small scale by some firms in India. The question of large scale manufacture of all these would naturally be taken up when a synthetic organic chemical or dyestuff industry is established and the use of electricity becomes more extensive. This is an important line which has made great progress in the U.S.A. in recent years and we think that in India also it should be developed by encouraging planned and systematic research in established scientific institutions.

GENERAL CONSIDERATIONS AND CONCLUSIONS.

It is seen from the foregoing pages that Heavy and Electro-Chemical Industries can be divided into three broad groups:—

(i) Sulphuric acid and salts; (ii) Soda ash and lime-soda; and (iii) Chemicals which can be manufactured only where plenty of cheap electrical energy is available; electrolytic caustic soda would belong to this group. Although it would have been desirable at the outset to locate these groups in specially selected areas, thereby creating industrial centres, it is not possible to do so now as heavy chemical industries have already been located in many places distributed all over the country.

In conclusion, we recommend as follows:—

2. (i) Heavy and Electro-Chemical industries should be developed in India. For want of these, India suffered considerably during the recent war. In view of the large hydro-electric developments being planned in different parts of India, the availability of raw materials in many cases and the imporance of electro-chemical industries to the country, conditions are specially favourable for the establishment of these industries also on a large scale.

(ii) In order to establish these industries on a sound footing, the Government of India should have a staff of experts whose services would be available to the various industries, particularly small scale ones.

(iii) Government should give the necessary protection against imports to those industries which find it difficult to compete, due to the higher cost of these Chemicals (manufactured in India) they require for their manufacture. Relevant examples are soap which requires caustic soda and glass which depends on soda ash.

(iv) Excise duties as in the case of salt, alcohol, benzene etc., or any other disabilities, e.g., licence required for the storage of sulphur which are not conducive to development should be removed.

(v) Raw materials including fuel oils, plants and scientific instruments for these industries should not be subject to any duty.

(vi) Cheap transport of raw materials and finished products from and to the different parts of the country is an essential condition for the successful development of these industries, which in the case of electro-chemical industries have to be located at sites of power generation to which raw materials have to be transported. There have been persistent complaints that freight charges are very heavy in India. We have already referred to the case of raw materials for aluminium manufacture. We feel that railways have to consider Indian Industries as a national asset and give all necessary help to enable them to thrive and face foreign competition, by the grant of specially low freight rates.

(vii) The development of electro-chemical industries and their successful working depends on the supply of cheap abundant power to these industries. Heavy Chemical Industries also would benefit by the supply of cheap power. Calculation of power costs in the old orthodox way allowing for interest, depreciation, etc., will put up the cost of power with the consequence

that the consuming industries will be strangled. Even though a hydro-electric project may not by itself, pay an adequate return on the basis of orthodox canons of finance, the indirect benefits to the country by the development of these industries will more than compensate for this apparent loss. The importance of the use of electricity in India where the fuel resources are not too plentiful and even those available are concentrated in one area cannot be too strongly emphasized. Rates for electrical energy in foreign countries for such industries are, we understand, as low as £3 or even less per H.P. year. In India, 0.1 to 0.15 anna per KWH would be a fair rate for those electro-chemical industries in whirh cost of power is a major factor. Such a low rate is essential, when one takes into account the other disadvantages such as smaller production, heavy freight charges etc. suffered by them. Reference may be invited to Appendix IX, in this connection.

(viii) We understand that minerals which form important raw materials for chemical industries belong, at present, to the Governments of the Provinces and States, in which they occur. In order to ensure the development of the mineral resources on an All-India basis, we recommend to the Government of India that mineral resources must be included among the Central Subjects.

(ix) Manufacture of electrical equipment—electrodes, furnaces and transformers, is being carried on to some extent now, but has to be developed much more if India is to be self-contained with regard to these industries. Special mention must be made of electrodes, large quantities of which are consumed continuously by these industries. Appendix XIV deals with the electrical equipment required for electro-chemical industries.

(x) We understand that planned dovetailing of seasonal employment has been taken up in the U.S.A. and the possibility of organising it in India also may be examined. Cheap secondary power could be made available during the flood season; in some places, we understand that old machinery whose cost has been completely recovered is available and we recommend that such machinery should be utilised for generation of secondary power; in such cases, power would be available at almost no cost. This could be utilised by the electro-chemical industries with profit. During the period when no secondary power is available, these industries will either have to suspend operations or be worked on power from thermal stations. The latter may not be economical in most parts of India. Even if these factories are closed during the off-season, the staff and labour can be usefully employed in any cottage or other industries not requiring much power. If this is possible, it is only capital cost charges that will have to be distributed over half the years' production. This scheme requires careful organisation and goodwill and we recommend that it may be examined by the Government and by the other Panels.

(xi) We should also like to refer to the desirability of manufacturing machinery and equipment required for chemical industies in India itself. This, however, may not be possible immediately. We understand that the Industrial Plant & Machinery Panel is examining this question in detail. We should like to recommend, however, that a beginning may be made by taking up fabri-

cation of such equipment as may be possible with the capital machinery already available in India. In many cases, lease of patents may not be necessary.

3. As stated at the beginning of the report, the consumption of these chemicals depends on the development of the consuming industries, the extent of which is difficult to estimate in view of the continuously changing conditions in the world to-day. Therefore, it has not been easy for us to fix with any accuracy five-year-targets for Heavy Chemicals, whose consumption will depend upon various other factors, such as expansion of and competition from industries in other countries, the support Indian industries will get from Government, etc. Synthetic dye and explosives industries are large consumers of Heavy Chemicals and development of this industry will depend on the successful establishment of those industries. Reference has been made (vide para 94) to the contemplated early start of synthetic dyestuffs industry in India. The effect of this industry will be large on development of other chemical industries—coal tar distillation, heavy chemicals, etc., which supply the raw materials and others like fine chemicals, pharmaceuticals, synthetic resins, explosives etc., which develop from the dye industry. Some of the raw materials for the dyestuffs industry will have to be manufactured by the industry itself while some others will have to be obtained from other sources. There has been no attempt so far for starting the manufacture of peace-time explosives, but it will have to be taken up soon. Therefore, while the targets suggested are based on a consideration of the existing conditions, those who will be entrusted with the task of giving effect to our recommendations may have to modify them suitably, should the changed conditions at the time of execution require it.

4. Reliable statistics form the basis of any well organized plan or development. We were handicapped at the very outset by lack of co-ordinated and reliable data relating to the industries dealt with in this report. Attempts have been made at different times by various Departments and bodies including the Indian Tariff Board to collect reliable figures of production and distribution of many articles in this country, but it would be difficult indeed to accept as strictly accurate the data collected by any single individual or Department or Institution. We have made an earnest attempt to collect the data from various sources and reconcile them. Although we do not claim any finality for our figures, it will be generally accepted, we are sure, that our report will serve a useful and practical purpose when dealing with the chemical industries in India.

ACKNOWLEDGMENTS.

We are thankful to many officers, Departments and Institutions for supplying us the data contained in this Report.

The Panels had the benefit of discussions at separate meetings with Mr. Morton S. Cressy, Chemical Expert from The Chemical Construction Corporation of America, who had been invited by the Government of India to advise them on the development of chemical industries in India. We are thankful to the Government for giving

us this opportunity of discussing with Mr. Cressy the scope of Chemical developments in India. Mr. Cressy toured all over India with our Secretary, Dr. K. A. N. Rao and his report on chemical industries will, we understand, be submitted to the Government of India shortly. Owing to the desire of Government for early submission of our report, we have not had the full benefit of Mr. Cressy's views.

We wish to thank Mr. D. N. Wadia, Mineral Adviser to the Government of India, who attended all the meetings of the Panels and gave valuable suggestions on all the subjects relating to minerals. To assist the Panels in their consideration of the subject of common salt, the Central Board of Revenue deputed Mr. H. A. C. Gill and Dr. S. S. Aiyar to meet the Panels and clarify certain points. The Public Health Commissioner also kindly deputed Major T. C. Puri, Deputy Public Health Commissioner to clarify some points about DDT. Our thanks are due to all of them.

We wish to place on record our appreciation of the arduous work of our energetic and hard-working Secretary, Dr. K. A. N. Rao. He came to us, apart from his scientific attainments, with a fund of research and industrial experience, and we would like to express our thanks to him for his valuable work. The Secretary's staff have put in excellent teamwork and they also deserve special mention.

Heavy Chemical Industries Panel.	*Electro-Chemical Industries Panel.*
Shri Ram.	J. C. Ghosh.
M. S. Patel.	B. K. Ram Prasad.
V. Seshasayee.	Kenneth Hall.
S. G. Sastry.	M. S. Patel.

K. A. N. Rao Secretary.

PART I.

SUMMARY OF MAIN RECOMMENDATIONS.

Importance of a sound Heavy Chemical Industry for the industrial advancement of India.

Sulphuric Acid:

Present production	...	...	About 59,000 tons.
Existing capacity	...	...	About 77,000 tons.
Present consumption	...	...	About 55,760 tons.

(i) Five-year target including the acid required for rayon industry: 152,600 tons.

(ii) This target to be achieved by the installation of fifteen 10-ton per day units and one Government experimental plant for producing 35 tons of sulphuric acid and 12 tons of sulphur per day from gypsum, in addition to plants for which import licences have been granted. Balance of 23,600 tons to be allocated after location of rayon plants is decided. Cost of capital equipment, Rs. 37.5 lakhs, excluding the Government plant.

NOTE.—*All figures are expressed in terms of* 100 *per cent. Sulphuric Acid.*

(iii) Import of Spanish pyrites to be arranged for the manufacture of copper and sulphuric acid.

(iv) *Location.*—Sind, Bombay, Bihar and C.P.

(v) A staff of Government experts to be maintained for paying visits to factories and give technical advice.

(vi) Some scholars proceeding to the U.K. and the U.S.A. to specialise in sulphuric acid industry.

(vii) Foreign technical experts necessary only for the Government experimental plant.

(viii) Bulk purchase of sulphur by a single corporation to be arranged for supplying sulphur to all the industries requiring it.

(ix) Ceiling prices for the acid based on the cost of sulphur to be fixed by Government periodically.

(x) Chamber acid to be used as far as possible for the manufacture of fertilisers.

Sulphates:

Sulphate of alumina.—Present consumption ... 20,500 tons.

Five-year target ... ... 38,000 tons.

Magnesium sulphate.—Total Indian production: 3,500—4,000 tons. This can be increased if necessary.

Iron sulphate.—Present prodoction of 2,000 tons sufficient. This can be increased if necessary.

Copper sulphate.—Estimated Indian production 900 tons. Requirements about 2,000 tons.

(i) No increase of manufacture from slender Indion resources of copper.

(ii) Manufacture to be arranged from imported copper pyrites.

(iii) Copper sulphate imported for agricultural purposes should be free of duty.

Sodium sulphate.—Consumption about 4,000 tons. Large deposits are available in the Didwana Salt Range, Jodhpur, in addition to manufacture in hydrochloric acid and dichromate plants. No action is necessary.

Other Sulphur Compounds:

Sodium sulphide: Present demand about 3,700 tons per annum. Five-year target 7,000 tons.

(i) Jodhpur State to be addressed by the Government of India to expedite manufacture.

Sodium thiosulphate (Hypo).—Demand more than 500 tons. Local manufacture is expected to meet the demand. No action is necessary.

Sodium Hydrosulphite (Hydros).—Pre-war requirements 1,600 tons.

(i) Five-year target 2,500—3,000 tons.

(ii) Manufacture to be taken up in India for which cheap zinc and sulphur dioxide are necessary.

(iii) Investigations of alternative processes utilising Indian raw materials should be continued by the Council of Scientific and Industrial Research.

Alkali Industries:

Common salt.—(i) Chemical industries to be supplied common salt by Government at cost of manufacture which should be reduced to as low a figure as possible.

(ii) Salt dust to be given free of charge or at least at the same uniform rate to all industries.

Lime.—Lime of guaranteed quality essential for chemical industries.

(i) Installation of modern lime kilns in different areas.

Soda ash.—Present consumption 107,500 tons per annum. Present capacity 74,000 tons; production much less.

(i) Five-year target: 270,000 tons.

(ii) To achieve this target, four new plants are recommended; two 50,000-ton plants, one each in Sind and in Bihar, two 30,000-ton plants, one each in South India and in the C.P.

(iii) Collection of the chemical from Reh deposits to be organised properly.

(iv) Estimated requirements of capital goods: about Rs. 6 crores.

(v) Technical advice from abroad necessary.

(vi) Indian chemists and engineers to be trained in the U.K. and the U.S.A.

Caustic Soda.—Present consumption about 54,000 tons. Present capacity 12,600 tons.

(i) Five year target 133,000 tons including requirements of rayon industry (45,000 tons electrolytic and the balance by the lime-soda process).

(ii) Requirements of capital goods: about Rs. 16 lakhs for each 5-ton plant.

(iii) *Location.*—One 11,000-ton mercury cell plant in Bihar and the others distributed in different parts of India.

(iv) Manufacture of 30,000 tons in all of DDT and Hexachloroeyclohexane (666), the two valuable insecticides from the chlorine produced in electrolytic alkali plants.

(v) Government to employ experts to visit plants and give technical advice.

(vi) India chemical engineers to be trained in the U.K. and the U.S.A.

(vii) Such protection as will not penalise the consuming industries to be given.

Potassium chlorate.—Pre-war consumption about 2,000 tons per year. Existing production about 2,000 tons.

(i) A plant of 1,000—1,500 tons capacity to be installed in one of the alkali plants.

(ii) The raw material, potassium chloride manufactured in India not sufficiently pure and must be made suitable for the manufacture of potassium chlorate.

Hydrochloric Acid:

Present production 2,500 tons.

(i) For any extra production required, manufacture from hydrogen and chlorine must be adopted.

Zinc chloride.—About 2,000 tons imported annually. Cheap zinc residues essential for manufacture in India.

Magnesium chloride.—Indian demand 7,000 tons. Manufacture is more than sufficient.

Calcium chloride.—Present Indian capacity is more than sufficient to meet the demand of 1,000 tons.

Potassium chloride.—Imports about 3,000 tons.

(i) Existing manufacture from bitterns and from Reh deposits should be increased.

Barium chloride.—Manufacture of 1,000—1,500 tons per year to be taken up in one of the alkali plants.

Nitric Acid.—Local supply is equal to the demand of about 1,300 tons.

(i) Five-year target: 4,000 tons.

(ii) Production in Ordnance factories should be utilised for civilian purposes.

Potassium nitrate.—Indigenous production is sufficient to meet the demand if this industry is organised properly.

Ammonia.—(i) 12,000—15,000 tons of ammonia manufactured at Sindhri or Alwaye should be reserved for the manufacture of ammonium salts and other chemicals.

(ii) No new plants to be installed for the present.

Urea.—(i) Five-year target: 10,000 tons.

(ii) To be manufactured at Sindhri from ammonia available there.

Phosphates.—(i) Five-year target for superphates 100,000 tons per year.

(ii) An experimental plant for manufacture of 10 tons of phosphorus per day and of concentrated phosphates by the electro-thermal process should be installed by Government.

Calcium carbide.—See Part II.

Dichromates.—Present capacity of 5,000 tons per year is more than sufficient to meet the demand.

Glycerine.—Present production is more than sufficient for Indian requirements.

Methyl Alcohol and Formaldehyde.—Large scale mnaufacture to be taken up at Sindhri.

Coal Tar Products.—Manufacture should be increased.

Other Industries.—The desirability of developing crude petroleum cracking and refining, and peace-time explosives industries.

PART II.

Importance of Electro-chemical Industries, which are superior in many cases to the older chemical processes. Importance of cost of electrical energy.

Caustic Soda, Caustic Potash and Chlorine; Potassium Chlorate.—See Part I.

Hydrogen Peroxide.—One plant of 350—400 tons capacity per year expected to be installed in Bombay.

(i) More plants to be installed when there is a definite demand.

Calcium Carbide.—Present Indian demand: 3,500 tons.

(i) Five-year target 7,000 tons.

(ii) *Location.*—One 5,000-ton plant in Bihar and one 2,000—2,500 ton plant in South India.

Ammonia.—See Part I.

Carbon Disulphide.—Required for rayon and oil industries.

(i) 8,760 tons per year required by Rayon Industry to be prepared in the rayon factories themselves.

Artificial Abrasives.—(i) Installation of furnaces with a capacity of 2,000 tons for each of the abrasives given in the report should be installed near source of power.

(ii) Firms who have already established manufacture of bonded abrasives should be given concessions for the manufacture of grains.

Artificial Graphite and Electrodes.—Small quantities of carbon electrodes are being made at present in India.

(i) Government itself should instal one or two plants for manufacture of graphite electrodes, if manufacture by the Company started in Travancore does not materialise within a reasonable length of time.

(ii) First calcination of petroleum coke should be carried out in the oil refinery itself before supply of coke to graphite plant; this will save freight charges.

Ferro-Alloys:

Ferro-manganese.—Sandur State is considered suitable for locating this industry.

Ferro-silicon.—Mysore is manufacturing 2,000 tons per annum.

(i) Total Indian demand is expected to be 4,000 tons, which Mysore can supply.

Aluminium.—Present total production capacity: 7,500 tons per year, which provision for developing it to 10,000 tons.

(i) Five-year target 15,000 tons per annum, with provision for 20,000 tons later.

(ii) To achieve this target, another aluminium plant of 5,000 tons immediate capacity ultimately to be raised to 8,000—10,000 tons should be installed near a source of power supply.

(iii) Special concessions such as cheap transport and protection (subsidy to protect consumer industries) should be given to this industry during the next five years, which can be reduced if power situation improves, after which it is sufficient if railway concessions comparable to Canadian and the U.S.A. rates are given.

Magnesium.—(i) Government should put up a small plant of 3—5 tons a day: Manufacture by the Pidgeon process.

(ii) Government should purchase and stock 1,000 tons of the metal for supply to Indian manufacturers at cost price.

Copper.—Present production 6,000 tons. Consumption of copper and alloy 50,000 tons.

(i) Five-year target: 10,000 tons of copper.

(ii) Other deposits of copper should be examined in order to develop production.

(iii) Import of copper pyrites should be arranged for manufacture of copper and sulphuric acid.

(iv) One 5,000-ton unit for manufacture of primary metals from scrap should be established at one of the sea port towns. Scrap for this purpose should be permitted to be imported free of duty.

(v) Low grade copper ores should be used for making copper

Electro-Plating.—Large units for electro-plating industrial equipment should be installed.

Storage Batteries.—Present estimated requirement 75,000 per year.

(i) Five-year taget: 100,000—125,000.

(ii) Existing five firms will be able to supply the requirements if reasonable protection is given.

Dry Cells.—Factories in India are supplying the demand.

(i) Indigenous raw materials are not being used. This must be done after some processing if necessary.

(ii) Possibility of manufacture on a cottage industry basis as in Japan should be examined.

No summary of "General Considerations and Conclusions" is given as that section itself is in the nature of a summary. Therefore, that will have to be considered as supplementary to the "Summary of Recommendations" of Part I and II.

APPENDIX I.

Industry.	Capital invested in India.
	Rs.
Cotton textiles	100 crores.
Iron & Steel	*25 crores.
Sugar	33 crores.
Jute	*30 crores.
Heavy Chemicals	5 crores.
Cement	17·5 crores.

Note.—*Both preference and debenture capital included.

Regarding Iron & Steel, nostatistics are available with regard to money invested in re-rolling, mills, as also investment in Engineering Industries.

APPENDIX II.

Heavy Chemicals.

I. *Sulphur and its compounds.*—

(a) Sulphuric Acid:
(b) (i) Aluminium sulphate and alums.
(ii) Magnesium sulphate (Epsom salt).
(iii) Iron sulphate.
(iv) Copper sulphate.
(v) Sodium Sulphate.
(c) (i) Sodium sulphide.
(ii) Sodium sulphite.
(iii) Sodium thiosulphate.
(iv) Sodium hydrosulphite.

II. *Alkali Industries.*—

(a) Common salt.
(b) Lime.
(c) Soda ash.
(d) (i) Sodium bicarbonate.
(ii) Sodium silicate.
(iii) Cyanides and Ferro-cyanides.
(e) Caustic soda & chlorine.
(Caustic potash).
(f) Potassium Chlorate.

III.

(a) Hydrochloric acid.
(b) (i) Zinc chloride.
(ii) Magnesium chloride.
(iii) Calcium chloride.
(iv) Potassium chloride.
(v) Barium chloride.
(vi) Ferric chloride, c

IV. (a) Nitric acid.
(b) Potassium nitrate.

V. (a) Ammonia.
(b) (i) Ammonium chloride.
(ii) Ammonium carbonate.
(iii) Ammonium bicarbonate.

VI. *Fertilisers.*—
(a) Nitrogenous fertilisers:—
(i) Ammonium sulphate.
(ii) Urea.
(iii) Ammonium nitrate.
(iv) Potassium nitrate.
(v) Cyanamide.
(b) Phosphate fertilisers.
(Phosphorus).
(c) Potash fertilisers.

VII. *Other Inorganic Chemicals.*—
Calcium carbide.
(a) Magnesia.
(b) Arsenic.
(c) Borax.
(d) Dichromates and chromic acid.

VIII. *Other organic substances and derivatives.*
(i) Ethyl alcohol.
(ii) Acetic acid.
(iii) Lead acetate.
(iv) Sodium acetate.
(v) Glycerine.
(vi) Formaldehyde.
(vii) Starch and glucose.
(viii) Acetone.

IX. *Industrial gases.*
(i) Oxygen.
(ii) Hydrogen.
(iii) Carbon dioxide.

X. *Coal tar products.*
(Phenol, Cresylic acid Naphthalene, Creosote and benzene).

XI. Miscellaneous.

APPENDIX III

Annual Production of Sulphuric Acid in tons (Area-wise).

(Calculated as 100 per cent.)

		Total	New Plants	
		in (1944)	Recently erected.	Import license granted.
		(1)	(2)	(3)
Bengal—				
C. 1.	Bengal Chemical and Pharmaceutical Works Ltd., Calcutta ...	3,970		
2.	Bellighatta Acid Chemical Works, Calcutta	695		
3.	India Chemical Industries Ltd., Calcutta ...	498		
4.	The Indian Iron and Steel Co. Ltd. Calcutta ...	6,341		
5.	D. Waldie and Co. Ltd. Calcutta.	1,403		
			13,000	
C.	One 10-ton contact plant recently installed	...		3,000
Assam—				
C. *1.	Assam Oil Co., Digboi ...	1,490	1,490	
Bihar—				
*1.	Rohtas Industries, Dalmianagar ..	1,433		
C. *2.	The Tata Iron & Steel Co. Ltd. ..	12,651		
*3.	Tinplate & Co.. Calcutta ...	3,241		
*4.	Bararee Coke Co., Calcutta ...	842		
*5.	Burrakar Coal Co., Ltd, Calcutta.	801		
			19.000	
C.	One 10-ton contact plant recently installed	...		3,000
	One 10-ton contact plant (Import license granted)	...		3,000
U. P.—				
1.	Cawnpore Chemical Works, Cawnpore	4,436		
2.	Mining & Chemical Industries Ltd., Agra	425		
3.	U. P. Glass Works, Bhajori ...	39		
			4,900	
Delhi—				
1.	Shambhunath & Sons Ltd., Delhi	406		
2.	D. C. M. Chemical Works, Delhi.	2,202		
3.	Ajodhya Prasad Chemical Works, Ghaziabad.	254		
4.	Frontier Chemical Works, Delhi.	...		
5.	Delhi Acid & Chemical Works. Delhi	...	3,000	
C.	One 10-ton plant recently installed.	...		3,000

		(1)	(2)	(3)
Punjab—				
1.	Cawnpore Chemical Works, Khasa ...	446		
2.	S. P. Chemical Works, Amritsar ...	426		
3.	Shambhu Nath & Sons Ltd., Amritsar	1,641		
4.	Amritsar Chemical Works, Amritsar...	44		
5.	Frontier Chemical Works, Rawalpindi.	121		
			2,700	
Sind—				
1.	Ganga Ram Khusal Das, Sukkur (Sind)	29 7		
			30	
Bombay—				
1.	Dharamsi Morarji Chemical Co., Ltd .	3,594		
2.	Eastern Chemical Co. Ltd. .	2,486		
3.	Sonawala Co. Ltd., ...	1,811		
			7,900	
Baroda and Ahmedabad—				
1.	Ramco Chemical Works, Ahmedabad ...	526		
2.	Star Chemical Works, Baroda ...	390		
3.	Petiad Turkey Red Dye Works, Petlad.	313		
			1,230	
C.	One 10-ton contact plant recently installed			3,000
Mysore—				
C. 1.	The Mysore Chemicals and Fertilisers Ltd.	4,170		
			4,170	
Madras—				
**1.	The East India Distilleries and Sugar Factories Ltd., (Managing Agent : M/s Parry & Co. Ltd.)	1,680		
			1,680	
	One 35-ton gypsum-sulphuric acid plant (import licence granted)			10,500
Hyderabad—				
1.	Hyderabad Chemicals & Fertilisers ...	159	160	
Travancore—				
‖ 1.	Travancore Fertilisers and Chemicals ...			3,000
		@59,000		
		capacity 65,000	Cap. 77,000	cap. 93,500

Note —

*Producing acids mostly for their own consumption.

†Messrs, Parry & Co. propose to expand production to 4,000 tons. This extra production will be used up to manufacture superphosphate for supply to the Government of Madras.

‡This firm proposes to put up a 75-ton plant per day, but only 3,000 tons will be available for sale.

C Contact plants.

@ Production in 1944.

APPENDIX IV.

EQUIPMENT FOR A CONTACT SULPHURIC ACID PLANT DAILY CAPACITY: 10 TONS.

Blower:

It is understood that there is no commercial concern in India manufacturing these blowers at present. Ordrance factories are, however, manufacturing other types of blowers and they could make these also provided they are supplied machine drawings.

The V-Belt drive, complete with sheaves, can also be manufactured in India, it is, understood.

20. H. P. Motor can be made in electrical workshops.

2. Sulphur melter, sulphur burner shell, converter shell, intercooler, SO_3 cooler, drying tower shell and absorbing tower shell can all be made in India, except for tubes.

3. *Molten sulphur pump*.—It is understood that some engineering firms and Ordnance factories can manufacture these pumps, but experience alone will show whether they will be satisfactory.

1. H.P. Motor with starter can be manufactured in electrical workshops.

4. *Vanadium catalyst*.—This will have to be imported.

5. 98 *per cent. acid and oleum tanks and pumps*.—The tanks can be manufactured if drawings and detailed specifications are available. Pumps for 98 per cent. acid pump tank and oleum pump tank cannot be made in India as the internal bearings, journals and impeller clearance rings have all to be of Illium.

5. H.P. totally enclosed motors can be made in India.

The pump packings and packing rings cannot be made in India, as they must be hard burnt and vitrified and of approved chemical acid resisting ware.

6. Chemical ware orifices cannot be made in India.

7. It will be necessary to import an oil burner and perhaps a blower for starting the plant.

8. It is understood that acid-proof bricks are available, but use alone can decide whether they will be suitable.

Whether acid proof cement is also available is not known with certainty. Insulating concrete may be available in India. Quarta pebbles for tower packing and other purposes may perhaps be obtainable in India. Whether all these are satisfactory has to be examined carefully.

It is understood that there are no facilities in India now for manufacturing gas or acid pipes.

Valves and fittings also have to be obtained from outside.

All indicating and recording instruments will have to be imported at least for some time to come.

It has to be stated that since the number of units required will be small, the cost of manufacture would be high compared to that of the imported machinery. Further, in all the cases, complete working drawings and specifications from the designers will be necessary. Whether these can be obtained without payment of heavy royalty fees has to be examined.

APPENDIX V.

Analyses of the type of salt used in America for electrolysis and a few typical samples of Indian salts are given below :—

Rock salt considered suitable for electrolysis in the U.S.A.		*Clean rock salt from Khewra mines.	
Sodium chloride	98·5 %	Sodium chloride ...	98·31%
Insoluble matter	0·57%	Insoluble matter ...	0·11%
Moisture	0·07%	Moisture	0·10%
Calcium oxide (CaO) ...	0·28%	Sodium sulphate ...	0·44%
Magnesium Oxide (MgO) ...	Trace	Calcium sulphate ...	0·71%
Sulphate as SO_3	0·12%	Magnesium sulphate ...	0·33%
Iron as Fe_2O_3	Trace		

*Rajputana Salt	Sambhar.	Pachbadra.
Sodium chloride	98·14%	97·10%
Insouble matter	0·43%	0·32%
Moisture	0·65%	0·90%
Sodium sulphate	0·27%	...
Calcium sulphate	0·34%	1·29%
Magnesium sulphate	...	0·27%
Magnesium chloride	...	0·12%

*_Kharaghoda and Kuda salts_—

	Kharaghoda	Kuda.
Sodium chloride	96.99%	98·47%
Insoluble matter	0·13%	0·31%
Calcium sulphate	1·66%	0·81%
Magnesium sulphate	0·19%	0·08%
Magnesium chloride	0·90%	0·32%
Potassium chloride	0·08%	...
Calcium carbonate	0·03%	...
Magnesium bromide	0·02%	...

	||*Bombay Presidency salt.	||*Madras salt.
Sodium chloride	95·43%	92·72%
Insoluble matter	0·94%	2·82%
Calcium sulphate	1·12%	0·98% (calcium salts.)
Magnesium sulphate	1·10%	1·36%
Magnesium chloride	1·41%	2·12%

*_Salt imported into Bengal_—

Moisture	3·4%
ON A DRY BASIS:	
Sodium chloride	97·5%
Insoluble matter	0·2%
Calcium sulphate	1·4%
Magnesium sulphate	0·3%
Magnesium chloride	0·6%

Note:—*These figures have been taken from Kapilram H. Vakil's monograph on "Salt."

|| These analyses obviously refer to dry basis.

APPENDIX VI.

The following are examples of important Indian limestones with their analyses:—

Serial No.	Locality.	Composition					Remarks.
		$CaCO_3$	$MgCO_3$	Al_2O_3 $F^{\circ}{}_2O_3$	Silic. Insolubles.	Other impurities.	
1	Katni Jubbulpur, C.P. ...	94·65	2·98	...	1·79	0·58	Practically inexhaustible.
2	Maihar (Rewa), C.I. ...	96·03	1·75	0·96	1·15	0·11	Practically inexhaustible.
3	Bisra (Gangpur), Eastern States Agency ...	95·18	1·57	1·04	1·87	0·34	Very large extent but associated with delomite bands.
4	Sylhet (Assam).	95·4	1·81	1·72	0·58	0·49	Practically unlimited.
5	Chela • (Khasi Hills Assam).	98·6	0·55	0·3	0·55	...	Very large, but exact extant unknown.
6	Hanspathar. C.P. ...	83·43	0·78	...	16·18	0·7	Very large.
7	Dalli. Drug, C.P. ...	83·5	2·0	0·9	13·6	...	Very large.
8	Kandara, Chanda, C.P.	94 to 96·8	...	3·0 to 1·2	2 to 2·5	...	Quantity unknown, but presumably large.
9	South of Rohri, Sind ...	98·67	0·43	1·02	0·18	0·025	Very large.
10	Wardha Valley (Penganga).	96·8	...	1·2	2·0	...	
11	Palavanatham, Madras ...	98·24	0·43	0·06	0·57	0·7	
12	Anantagiri, Vizagapatam ...	96·73	2·50	0·23	0·56	...	

II. (1) *Bihar and Eastern States.*

High grade limestones occur at many places in Bihar, but data of their phosphorus content are wanting. Supplies of limestones for metallurgical purposes come from Birmitrapur in the Gangpur State. According to Dr. M. S. Krishnan, the reserves are approximately 137,500,000 tons. Of this quantity, 10 per cent. can be classed as first-grade and 25 per cent., as useful for lime making. The above figures are a conservative estimate. Very large quantities of Gangpur limestone are annually burnt for lime and for cement making.

The best limestone in Bihar occurs in the Shahabad district, the Rohtas limestone. In Mirzapur district, it occurs in beds, 700 ft. in maximum thickness. There are a good number of other limestone deposits in Bihar, but the deposits are not so pure and not of such wide extent. Hanspathar limestone (SiO_2 upto 16 per cent.), comes under this category.

(2) *Bombay.*—Limestones of good quality for use in the High Explosive Factory, Kirkee, are found in the Ahmednagar district, the localities being about 80 miles from Poona. The reserves, however, are not large, about 15,000 to 20,000 tons.

(3) *Central Provinces & Central India.*—C.P. contains valuable deposits of limestone, fit for burning to lime for Sugar Factories. There is also a large quantity of high grade limestones, fit for fluxing purposes. These limestones have been examined recently for their suitability for use in the manufacture of Calcium Carbide. Analyses of samples and other data may be obtained from the G.S.I. Limestones, carrying upto 1 per cent. MgO and 2 per cent. SiO_2, have been used successfully in carbide manufacture, provided phosphorus content is below 0.04 per cent. The reserves are not estimated in all cases, but it is probable that large quantities are available and are being worked for supplying to sugar factories, to lime kilns and to the iron works.

The following are the chief limestone areas of the C.P.:—

(a) *Jubbulpur—Katni—Satna area.*

(i) Katni area.
(ii) Jukehi—Kymore area.
(iii) Maihar area.
(iv) Satna area.

(b) Raipur district.

There are several quarries situated within two miles from Raipur town. The Katni limestone is quarried to the largest extent in the C.P. It is largely used for lime burning. The limestone is tough, massive and dark grey in colour. The $CaCo_3$ content varies from 93.20 to 96.4 and the MgO is below 2 per cent.

(4) *Madras.*—The limestone deposits of the Salem district have been examined by the G.S.I. for their suitability for Calcium Carbide manufacture and also for lime burning. The majority of the Salem limestone is found to be of good quality, rich in $CaCo_3$ with very small amounts of impurities. But some of the limestones are partly dolomitic. Preliminary prospecting gives a figure of about 700,000 tons.

Very high grade crystalline limestone (in part dolomitic) occurs in the Tinnevelly district, suitable for lime burning and for cement manufacture. Part of the limestone of Tinnevelly is of chemical grade.

These latter are estimated at about 200,000 tons. Other deposits have been located in Madura district.

(5) *Punjab.*—Limestone is abundant in all the districts of Northern Punjab, and N.W.F.P., a large proportion of which is of excellent quality, according to Mr. E. R. Gee of the G.S.I.

Salt Range.—Enormous deposits of fine quality limestone occur here along almost the whole length of the Range. A number of analyses shows 95 to 98 per cent. $CaCo_3$, silica less than 2 per cent. Generally, alumina 1 to 1½ per cent., MgO less than 1 per cent. It is possible to select beds of the required composition and purity from the limestones of different ages occurring in this Range.

Kalabagh, Makarwal and Kohat districts.

The large limestone deposits of this area are also of similar nature, both as regards quality and quantity.

Post-war area.—The limestone deposits of Wah analyse upto 98 per cent. $CaCo_3$, and are largely quarried for cement manufacture. Besides these, the hilly areas of Kalachitta and neighbouring hills contain large stones of good limestone.

(6) *Rajputana.*—The limestones of the Arawali hills are usually impure and dolomitic and are not fit for burning for lime. There are, however, a few deposits, e.g. Makrana marble, which yield excellent lime.

Jodhpur State.—Sojat-Bilara limestones are burnt for lime. Makrana limestone (a high quality marble) contains 98 per cent. $CaCo_3$, insoluble residue about 1 per cent. and Mgo under 2 per cent.

Sirohi State.—The quality of the limestone of Sirohi varies greatly, but a large number of kilns use it for burning.

Udaipur State.—Exports large quantities of limestone in flags and slabs. It is also good for making lime. Ajmer-Merwara, Alwar State, Bundi State, Jaipur State, Jaisalmer and Jodhpur, produce marble of good quality and of varegated colours. This limestone is put to use as an ornamental stone as well as for lime making.

(7) *United Provinces.*—A considerable amount of limestone, as a source of chemical lime and for the manufacture of Calcium Carbide occurs round Mussourie. The G.S.I. estimate conservatively the reserves at about 34 million tons. The $CaCo_3$ content varies from 95 per cent. to 99.10 per cent.; Silica varies from 0.15 to 0.02; Alumina varies from 0.25 to 0.1 and MgO from 0.36 to 0.07.

III. Production of limestone in the principal Provinces of India in an average year.

Bihar	680,000 tons.
C. P.	550,000 tons.
Eastern States Agency	1,000,000 tons.
Madras	about 200,000 tons.
Other areas...	1,000,000 tons.

(Note by Mr. D. N. Wadia).

APPENDIX VII.

List of Dichromate Factories in India.

	Capacity
Bombay—	
Poineer Chromates	.. 500 tons per annum.
Premier Chromates	... 700 „ „ „
Indentors Syndicate	... 250 „ „ „
Golden Chemicals	... 300 „ „ „
Calcutta—	
Bengal Chemical and Pharmaceutical Works	.. 200 tons per annum.
Chemical Corporation of India ...	. 100 „ „ „
Krishna Chemical Works	... 75 „ „ „
Chemical Industries Co. Ltd.	... 80 „ „ „
Zenith Commercial Co.	.. Just commenced. capacity not known.
Madras—	
Buckingham Carnatic Mills ...	... 1200 tons per annum
Mysore Government Factory, Belagula ...	... 350 „ „ „
National Chemicals, Masaulipatam ...	... Just commenced, capacity not known.
U.P.—	
Cawnpore Chemical Works, Cawnpore ...	... 1200 tons per annum.
Total	... 4955 tons.

APPENDIX VIII.

TAR PRODUCTION PLANTS IN INDIA.

Company.	Location.	Capacity per month.
Tata Iron & Steel Co.	Jamshedpur	4,000 tons.
Indian Iron & Steel Co.	Hirapur ...	1,500 „
	Kulti ...	500 „
Barrakar Coal Co.	Layabad, Jharia	200 „
Bararee Coke Co.	Kusunda, Jharia	300 „
Bhowrah Coke Co.	Jharia	150 „
Lodna Coke Co.	Lodna, Jharia	150 „
E. I. R. By-Product Coking Plant	Giridih ...	75 „
Oriental Gas Co	Calcutta ...	250 „
Bombay Gas Co.	Bombay ...	250 „
		7,375 tons

TAR DISTILLATION PLANTS IN INDIA

Company.	Location.	Capacity per month.
Shalimar Tar Products Co. Ltd.	Lodna, Jharia.	4,000 tons.
Bengal Chemical and Pharmaceutical Works Ltd.	Calcutta ...	400 „
Bararee Coke Co.	Kusunda, Jharia	300 „
Bihar Chemical Traders ...	Howrah ...	150 „
Mumtaz & Co.	Calcutta ...	50 „
		4,900

Apart from these, there are at least 5 others mostly in Calcutta and Howrah whose plants had been working before the War but may not be considered as efficient ones.

APPENDIX IX.

POWER COSTS AT CERTAIN ELECTRO-CHEMICAL CENTRES OF THE WORLD.

Source of power Locality.	Source of power.	Power cost in anna per KWH.
Alabama U. S. A., ...	Steam ...	0·167 to 0·270
California U. S. A., ...	Steam ...	0·167 to 0 270
Montana U. S. A , ...	Hydro ...	0·131 to 0·176
Massena U. S. A., ...	Hydro ...	0·167
Niagara Falls U. S. A., ...	Hydro ...	0·131
St. Louis U. S. A.	Steam ...	0·176 to 0·220
Tennesse U. S. A.	Steam ...	0·167 to 0 270
Arvida Canada	Hydro	0 044 to 0 066
Ontario Canada	Hydro ...	0·066 to 0 176
Shawinigan Falls Canada... ...	Hydro ...	0 044 to 0 066
England	Steam ...	0·176 to 0 220
Scotland	Hydro ...	0·131 to 0·176
French Alps.	Hydro ...	0·090 to 0·131
Germany	Steam ...	0·154 to 0·176
Switzerland	Hydro ...	0·131
Norway	Hydro ...	0 044 to 0·066
Sweden	Hydro ...	0·044 to 0·066

Note.—Rates in India very considerably in different provinces and no special rates have been fixed for electro chemical industries, such industries, being very few in India. The lowest rate charged by the Government of Mysore is 0·125 anna per KWH and that by the Government of Madras, Rs. 60/- per K. W year.

APPENDIX X.

	Installed generating capacity (Kilowatts).			
	Steam	Diesel	Hydro	Total
BRITISH INDIA.				
Assam	208	1,706	500	2,414
Bengal	330,007	4,174	2,360	336,541
Bihar Public Utilities	23,200	3,886	...	27,086
Tata Iron & Steel Co.	107,200	...	...	107,200
Bombay	67,407	16,494	232,114	316,015
C. P	12,639	3,894	...	16,633
Delhi	17,900	4,386	...	22,286
Madras	47,150	6,035	69,650	122,835
N. W. F. P....	...	1,030	9,600	10,630
Punjab	26,478	12,907	49,750	89,135
Sind	2,025	15,365	...	17,390
U, P.	109,995	8,120	22,700	140,815
STATES.				
Baroda	...	4,761	...	4,761
Bikaner	4.000	...	...	4,000
Hyderabad	9,750	3,151	...	12,801
Kashmir	...	265	4,315	4,580
Mysore	...	...	61,000	61,000
Travancore	...	1,543	15,400	16,943
Other States...	8,824	27,506	410	36,740

(H. M. Mathews, Journal, Institute of Engineers, India, page 7—vol 26—No. I. Septmber, 1945).

APPROXIMATE FUTURE DEVELOPMENTS ARE NOTED BELOW :

Bombay—

Tata Hydro Elect. Agencies Ltd	30.000 KW
Future Govt. Developments	50,000 KW
Ahmedabad Electricity Co. Ltd	50,000 KW
Bengal (including developments of Calcutta Electricity Co. Ltd., and Indian Irom & Steel Co.)	120,000 KW
Madras (Hydro)	50,000 KW
Bihar (Including Tata Iron & Steel Co. and Patna Electricity Supply Co.).	35,000 KW
Damodar Scheme	300,000 KW
U. P. (including hydro and steam) Stations	15,000 KW
Punjab (including hydro and steam)	30,000 KW
Mysore	100.000 KW
Travancore	15,000 KW

Dr. B. K. Ramprashad

APPENDIX XI.

Electro-Chemical Industries.

I. *Electrolytic Processes.*

- (a) Caustic soda, Caustic potash and chlorine.
- (b) Potassium Chlorate.
- (c) Oxygen and Hydrogen.
- (d) Hydrogen Peroxide.

II. *Electro-thermal Processes.*

- (a) Phosphates.
- (b) Phosphorus.
- (c) Calcium carbide.
- (d) Calcium cyanamide.
- (e) Ammonia.
- (f) Carbon disulphide.
- (g) Artificial abrasives.
- (h) Artificial Graphite.

III. *Electro-metallurgy of metals.*

- (a) Iron and Steel.
- (b) Ferro-alloys.
- (c) Aluminium.
- (d) Magnesium.
- (e) Copper.
- (f) Zinc.

IV. *Electro-plating.*

V. *General.*

- (a) Storage batteries.
- (b) Dry cells.

VI. *Organic Chemicals.*

Products.	Unit of measure.	Unit of Selling Price (1).	Unit electric energy requirements (2).	Ratio of electric energy cost to selling price of finished product at selected unit costs—percent. Average unit cost of energy in cents per kilowatt-hour.												Energy costs of representative producers
				0·1	0·2	0·25	0·3	0·35	0 4	0·5	0·6	0·7	0·8	0·9	1·0	
Electrolytic			KWH													Censt per KWH (3)
Aluminium . .	Short Ton .	400·00	23,988 (4)	6 0	12·0	15·0	18·0	21·0	24·0	30·0	36 0	42 0	48·0	54·0	60·0	
Copper (electrolytic leaching).	Do. .	220·00	2,820	1·3	2·6	3·2	3·8	4·5	5·1	6·4	7·7	9·0	10·3	11·5	12·8	0·65
Coper (electrolytic rfining) .	Do. .	220·00	367	0·2	0·3	0·4	0·5	0·6	0·7	0 8	1·0	1·2	1·3	1·5	1·7	0·70
Zinc . . .	Do. .	100·00	3,714	3·7	7·4	9·3	11·1	13·0	14·9	18·6	22·3	26·0	29·7	33·4	37·1	0·25,0·0
Magnesium .	Do. .	600 00	20,000	3·3	6 7	8·3	10·0	11·7	13·3	16·7	20·0	23·3	26·7	30·0	33·3	(3)
Sodium (metallic).	Short ton of mettallic sodium and 3083 lbs. of chlorine . .	(5) 376·28	(4) 14,400	3·8	7·7	9·6	11·5	13·4	15·3	19·1	23·0	26·8	30·6	34·4	38·3	0·35
Chlorine and caustic soda.	Short ton of caustic soda and 1770 lbs. of chlorine.	(6) 109·15	3,009 (4)	2·8	5·5	6·9	8·3	9·6	11·0	13·8	16·5	19 3	22·1	24 8	27 6	0·35
Electro-thermal																
Ferromanganese	80% Long ton.	102 50	7,280 (4)	7·1	14·2	17·8	21·3	24·9	28·4	35·5	42·6	49·7	56 8	63·9	71·0	(3)
Ferrosilicon .	50% do. .	69·50 (7)	6,160	8·9	17·7	22·2	26·6	31·0	35·5	44 3	53·2	62·0	70·9	80·0	88·6	0·3,0·5
Fused alumina .	Short ton . .	56·04 (7)	3.143	5·6	11·2	14·0	16·8	19·6	22·4	28·0	33·7	39·3	44·9	50·5	56·1	0·35
Silicon carbide.	Do. .	72·03	9,380	12·9	25·7	32·2	38·6	45·0	51·4	64·3	77·2	90·0	102·9	115·8	128·6	0 35
Calcium car bide.	Do. .	100 00	3,150	3·2	6·3	7·9	9·4	11·0	12·6	15·8	18·9	22·0	25·2	28·4	31 5	0·35
Ailied.																
Anhydrous ammonia .	Do. .	90·00	1,530	1·7	3·4	4·2	5·1	6·0	6·8	8·5	10·2	11·9	13·6	15·3	17·0	0 3-0 5

(1) Represents manufacturer's prices as of January 3, 1938 from prices published by the Oil Paint and Drug Reporter, Engineering and Mining Journel, and Industrial and Engineering Chemistry except as noted. (2) Represents allenergy directly chargeable to each product for the operation specified, including electrolytic, electrothermal, motor lighting and incidental loads. (3) Representative data are not available. (4) Represents energy directly chargeable to process only. (5) Based on a price of 15.5 cents per pound for metallic sodium and 2·15 cent per pound for chlorine. (6) Based on a price of 2·7 cents per pound for caustic soda (76 per cent solid) and 2·15 eent per pound of chlorine. (7) Average value of United States and Canadian production of crude material during 1936, from data published by the U.S. Bureau of Mines.

APPENDIX XIII.

Note on the Pidgeon Process of Mg. production at the works of Dominion Magnesium Co., Haloy, Ontario.

For plant yielding 14.3 tons of distilled Mg. per day, the quantities of materials required to make a ton of distilled metal are as under:—

Raw Dolomite	9·3 tons
or Calcined Dolomite	4·9 „
Ferro Silicon	1·06 „
Fluor Spar	0·17 „
Coal for calcining dolomite	1·7 „
Power required per ton distilled metal:	
Heating retorts	11,000 K.W.H.
Manufacture of ferro-silicon	10,700 „
Total ...	21,700 K. W H.

The loss on melting distilled metal appears to be in the order of 1 per cent. owing to some fine powder being discarded.

The ferro-silicon contains on the average 76.5 per cent. silicon.

The dolomite used has the following analysis:—

	MgO	22·2%		MgO	40·5%
	CaO	30·1%		CaO	58·1%
Raw	R_2O_3	0·2%	Calcined	R_2O_3	0·8%
	Insol	0·3%		Insol	0·6%

Ratio of dolomite to ferro-silicon:

If theoretical proportion used, yield of Mg is 60 per cent.

If ferro-silicon is 20 per cent. in excess of theoretical needs, yield of Mg is 84 per cent.

Actually about 18—20 per cent. ferro-silicon in excess of theoretical needs is used.

Preparation of materials:

Dolomite ground—so that	60% passed 200 mesh
Ferro-silicon crushed—so that	all „ 55 „
Fluorpar (as bought)—so that ...	80% „ 200 „

APPENDIX XIV.

Equipment for Electro-Chemical Industry.

Items of equipment required in the electro-chemical industry may be classified as follows:—

(1) Transformers for furnace and for rotary convertors.

(2) Motor generators, rotary converters and dectifiers for eletrolytic works.

(3) Switchgear and metering equipment for control of the above (including equipment for measurement of temperature, pressure and high voltages).

(4) Electrodes and electrode mechanisms (graphite, carbon and self-baking types, for all electro-chemical processes).

(5) Furnaces : Arc. resistance and induction type.

(6) Materials for the manufacture of furnace and electrolytic cells, refractories for linings, operating machanisms and elements.

In the following paragraphs will be described the range of capacity of the items mentioned above. Such of these that can be manufactured in India in the immediate future will have to be selected from those.

(1) *Transformers.*—The design of transformers differs according to the various applications as noted below and should be properly selected.

(a) For steel furnaces they may be 3 phase and 500 to 5,000 KVA oil—immersed with secondary voltage taps rating 250—235—205—175—118 with on load or off load tap changing gear. Primary voltages may be 11,000 volts, 6,600 volts or 3,300 volts according to the nature of the supply available in a particular locality. The tabular statement of the capacities for various sizes of steel furnaces is noted below:—

Dia.	Normal charge.	Transformer rating.
4 ft.	800— 1,000 lbs.	250— 350 KVA.
5 ft.	1,500— 2,000 lbs.	500— 750 KVA.
6 ft.	3,000— 4,000 lbs.	750—1,000 KVA.
7 ft.	5,000— 6,000 lbs.	1,000—1,500 KVA.
8 ft.	7,000— 9,000 lbs.	1,500—2,000 KVA.
9 ft.	10,000—12,000 lbs.	2,000—3,000 KVA.
10 ft.	16,000—20,000 lbs.	2,500—3,000 KVA.

(b) For ferro-alloys such as ferro-silicon and ferro-chrome, the size of the transformers ranges from 2,500 to 10,000 KVA and the secondary rating will be 140/130/120/110/100/80 (open circuit and the primary voltage will be 11,000, 6,600 or 3,300 depending upon the locality).

(c) For carbide furnaces, the transformers will be slightly different in tapping arrangement and the sizes range from 5,000 to 10,000 KVA. Three phase transformers can be used for ranges upto 5,000 KVA and above that single phase transformers are preferable. Secondary volts are 150/144/138/126/114 volts.

(d) For graphite and carborundum; single phase transformers ranging from 1,000 to 2,000 KVA would be required. The initial

low tension voltage will have to be about 220 and capable of being adjusted down to about 75 volts in steps of about 10 volts from beginning of operation to the end of the run.

(e) Special transformers for rotary convertors and rectifiers are required.

The smaller size transformers can be manufactured in India in one of the existing transformer factories. The windings for the transformers may be made locally, as the Indian Cable Co. can supply the copper wire or strips. Stamping from alloy steel plates may be obtained from the Tata Iron & Steel Co.

(2) *Motor generators etc. for electrolytic work.*—For plants engaged in electro-plating and electro-winning work, small motor generator sets upto 100 KW with D.C. voltage ranging from 30 to 220 volts would be required. The motors would normally be squirrel cage type and generator of the Standard Types. These motor generators may be constructed in the motor works in India.

For large scale plants such as alkali-chlorine and hydrogen manufacture, equipment ranging from 5,000 to 10,000 amperes would be required and the machinery will be of the order of 3,000 to 4,000 KW. The power supply may be from motor generator sets, the motor being of the synchronous type and with a voltage of 3,300 volts. Rotary converters will also work satisfactorily and will probably be slightly lower in initial cost. For large size machines, it may not be possible to obtain all the necessary equipment in India, but the major items can be made locally.

Mercury are rectifiers of about 500 and above volts are satisfactory for large plants of electrolytic work. With the present trend of development of vacuum type equipment, the possibility of its manufacture in India needs careful examination.

(3) *Switchgear and metering equipment.*—Switchgear for the transformers and motor generator sets will all be of the standard type. The larger sizes will have to be imported for some time more. But several firms in India are already manufacturing the small size equipment and will be able to supply the needs of the electro-chemical industry to a certain extent.

They will consist of:

(1) Oil circuit breakers.
(2) Disconnecting switches.
(3) Fuse-gear.
(4) Bus bars and supports.
(5) Switchboard panels with meters, relays etc.

(4) *Electrodes.*—This is a very important item which is needed in large quantities by the existing industries and will be required in large quantities as extensions are carried out. There is a small factory in Travancore to manufacture graphite electrodes and similar plants may be started in Northern India. The graphite electrodes have got current carrying capacities varying from 500 to 30,000 amperes according to the diameter, as per the scale of current capacity noted below. The raw materials for electrodes are anthracite coal and petroleum coke. For binding purposes, tar or hard and soft pitch are necessary.

Sizes and current capacities are noted below:—

	Graphite.		Carbon (Amp.)	
2"	600/1,000	Amps.		
4"	1,800/3,000	„		
6"	3,100/5,400	„		
8"	5,500/9,000	„	2,000/3,000	Amps.
10"	7,800/12,500	„	3,000/4,800	„
12"	11,300/17,000	„		
14"	15,400/21,500	„	5,400/8,500	„
16"	20,100/26,100	„		
18"	25,500/30,500	„		
20"	28,300/34,600	„	11,000/17,300	„
24"			15,800/24,800	„
30"			24,700/35,300	„
40"			37,700/50,200	„

(5) *Furnaces*: *Arc, resistance and Induction Types.*—The following types of furnaces would be required:—

(a) Resister type using either carbon plates or carborundum rods or resister wires.

(b) Carborundum and graphite furnaces are of the simple combined resister type and all their materials are available in India and the designs are very simple. The graphite electrodes have to be of large sizes and could be manufactured locally. The capacity of the furnaces will be ranging from 1,000 to 2,500 KVA and they are very simple in operation.

(c) Special types of tunnel kilns would be required for porcelain. enamel and glass manufacture. The designs are simple and the materials for construction can be locally obtained.

(d) Arc furnaces of 3 phase type are required for ferro-alloys, steel manufacture and carbide production. The furnace capacities are noted below.

3. Phase furnaces for ferro-alloys and steels.	Single phase furnaces used for Non-ferrous alloys (docking type). Ranges in 25/100/250/600 KW sizes.
Chamber will be a steel bowl with a refractory lining. In steel furnaces, roof is removable, dome shape refractory structure carried on steel roof ring. Temperature around 1600°C Design Holding capacity shell Dia. Pouring capacity melting rate, are to be worked out.	80 to 7,000 lbs. capacity. (Two vertical electrode types are also used.)

(e) *Induction furnaces.*—Induction furnaces of the standard and also high frequency type are going to be in use as metallurgical developments improve. Standard frequency furnaces range from 50 to 200 KW with a voltage rating on the primary side of 220, 440 or 550. The construction is simple and the windings are of the transformer type. The lining is made of insulating bricks and with the binding materials of cement. For larger sizes upto 2 tons 3 phase furnaces would be necessary.

High frequency furnaces ranging from 400 to 1,200 cycles are built in 500 to 100 KW units. The voltage rating would be about 500 to 2,000 volts, but the majority of them operate at about 600 vol to and 1,000

cycles. The equipment for producing the high frequency consists of either spark gap type which can be easily constructed locally, using some of the special items imported from abroad. For large sizes, special motor generator sets upto 300 KW are required.

(6) *Materials for the manufacture of furnaces and electrolyric cells, refractories for linings, operating mechanisms and elements.*—(a) The shells are to be specially designed. Furnaces of 2,000 KVA would be the usual for ordinary requirements, but in special cases, furnaces of 10,000 KVA may be necessary. In South India, as production of pig iron in electric furnaces is being contemplated, furnaces of 12.000 KW are being designed. The designs are simple, the materials for the furnaces can be obtained locally and electrode holders, regulating mechanism and the relay equipment could also be made in the country. However, in the beginning, the relay equipment will have to be imported.

For small size furnaces for non-ferrous metal work, single phase furnaces of the rotary type ranging from 25 to 600 KW would be required with a capacity of quarter of a ton to 3 tons. Most of these can be manufactured locally and arrangements should be made for immediate investigations therefor.

(b) In the electrolytic industry, alkali chlorine cells of various types are in use in the country and if suitable arrangements can be made with the patentees, most of the cells can be built locally. The important types are: (i) Vorce eylindrical type, (ii) Billiter, jar type (iii) Allen Moore, and Nelson rectangular type and (iv) Mercury type. Items (i) and (ii) would require stoneware containers, whereas, items (iii) and (iv) would require cement and asbestos materials. The cathodes can be built of steel plate and the anodes of graphite electrodes.

(c) For hydrogen and oxygen production, several standard types are in use in the country, viz., steel tank type, and filter press type. The steel containers are easily built and the electrodes and diaphragms can be made locally.

(d) *Refractories.*—Most of the refractories used in the furnace could be manufactured in India including silica, chromite and carborundum bricks whichever is suited to the particular requirements. Refractory bricks are being manufactured in Bengal, South India, C.P. and Bombay, as all the required raw materials are available. The possibility of making special refractories should be investigated.

Conclusion.—It seems possible to make a start on the manufacture of small size transformers and motor generator sets, the transformers ranging in size 100 to 3,000 KVA and the meter generator sizes from 100 to 500 KW. It is usderstood that two factories are already manufacturing transformers, motors and generators, and a third one is likely to start operation. These firms should be in a position to make the required machinery for electro-chemical work. The insulation materials, wires, cables for windings for the machines will have to be obtained from the Indian Cable Co., and the stampings for the core of transformers and machines from the Tata Iron & Steel Co. The lamp and glass factories may take up the manufacture of rectifiers on a small scale and develop bigger units. Steel rectifiers are covered by special patents but they can be worked out by arrangements with the patientees.

As already mentioned, all electrodes, furnaces and refractory lining materials could be made locally.

(Dr. B. K. RAMPRASAD).

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REPORT

OF THE

PANEL ON LEATHER AND LEATHER GOODS

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GOVERNMENT OF INDIA
MINISTARY OF INDUSTARY & SUPPLY
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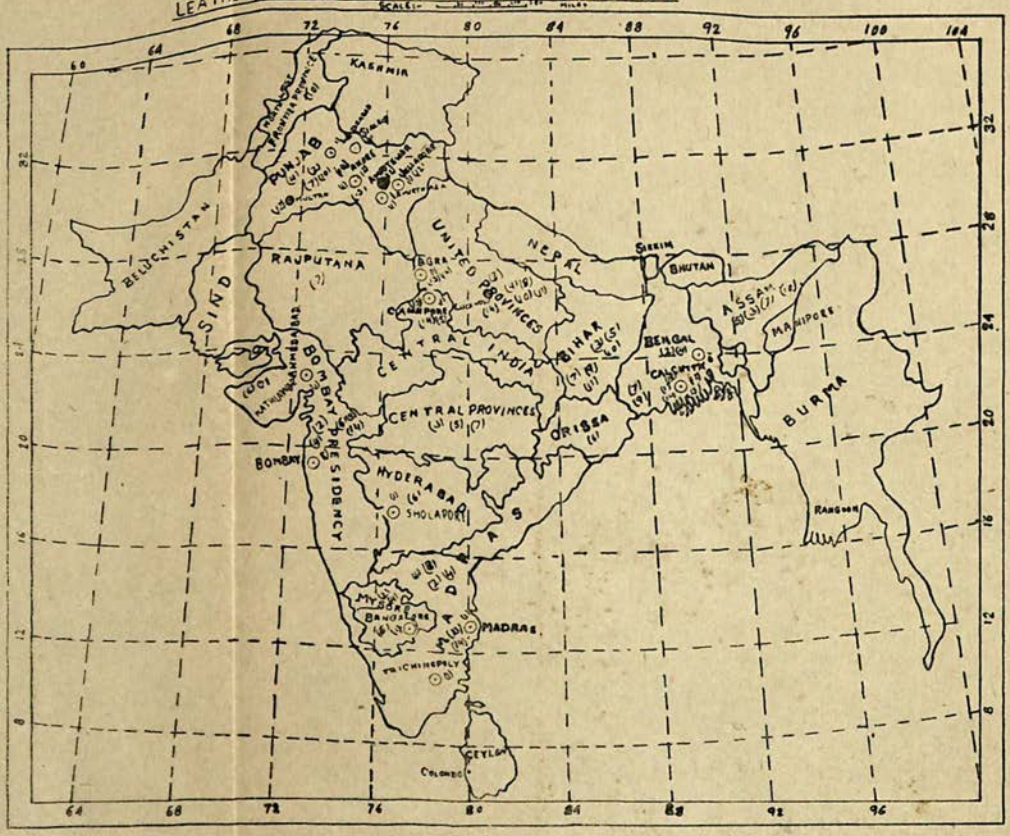
INDIA

IN RELATION TO

LEATHER, BOOT & SHOE AND LEATHER GOODS INDUSTRIES.



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CHAPTER I

Introduction

The Leather and Leather Goods Industries Panel was set up by the Department of Planning and Development of the Government of India to make recommendations to the Government regarding the development of those industries in India. In the General Directive issued to the Panels (Appendix I) it was suggested that the recommendations should be so framed as to enable the Government to prepare a detailed phased plan for the five years following the cessation of hostilities, as the first stage of a 15-year plan of development and should cover the 12 points in the Directive. These were the terms of reference to the Panel.

Constitution of the Panel

2. The Panel was composed of the following members initially:—

Chairman

Rai Bahadur B. M. Das, M.A. (Cal.), M.Sc. (Leeds), Superintendent, Bengal Tanning Institute, Government of Bengal.

Members

Sir M. Balasundaram Naidu, Hides & Skins Merchant, Ritherdon, Vepery, Madras.

Mr. Jamal Moideen, Leather Merchant, Madras.

Mr. A. C. Inskip, C.B.E., E.D., General Manager, M/s. Cooper, Allen & Co., Cownpore.

Mr. Kaiser Ahmed, Hides & Skins Merchant, Bombay.

Mr. Bool Chand, Dayalbagh Industries, Dayalbagh, Agra.

Capt. P. S. Choudhury, Directorate General of Supply, New Delhi.

Secretary

S. Datta, Assistant Industrial Adviser, P. & D. Deptt., New Delhi.

Later on the following members were co-opted.

Members

Mr. P. S. Pandit, Messrs. Western India Tanneries Ltd., Bombay.

Mr. S. K. Sen, Messrs. National Tannery Co., Ltd., Calcutta.

Mr. H. Raney, Messrs. Modern Indian Art Crafts, Bombay.

After the sudden and lamentable death of Mr. S. Datta, Mr. A. K. Datta was appointed to act as Secretary to the Panel.

Preliminary Report of the late Mr. S. Datta

3. As promised in paragraph 2 of the Government Directive, the Panel Secretary prepared a preliminary report giving factual informations concerning these industries, copies of which were circulated to members. The report has been very helpful to the Panel which expresses its appreciation to the late Mr. S. Datta for the pains he took in preparing it. The Panel also places on record its deep appreciation of the valuable services rendered by Mr. A. K. Datta in the concluding and reporting stage of the work of the Panel. In particular, the Panel thanks Mr. A. K. Datta for planning and working out the materials in Chapter XIII embodying the Materials and Personnel Budgets which have helped to concretise the development plan adumbrated by the Panel by bringing our means and ends in realistic relation with one another and into a broad, integral picture.

Panel Meetings

4. The Panel held eleven meetings as under:

3 at Calcutta,
1 at Madras,
1 at Bangalore,
1 at Bombay,
1 at Lahore,
1 at Jullundur,
1 at Cawnpore,
1 at Agra, and
1 at New Delhi.

A draft Report was presented at the meeting of the Panel held in Calcutta in April 1946. The draft Report which was approved by the Panel, was then circularised to all the Provincial and State Governments for scrutiny. At the New Delhi meeting held in August 1946, the Panel discussed the draft Report with the representatives of Provincial and State Governments. The representatives generally approved of the draft Report and offered their suggestions and views on a number of points. At the final meeting which was held in April 1947 in Calcutta, the suggestions and viewpoints were carefully considered by the Panel at the time of finalising the draft Report.

Contacting the Industries

4a. To elicit the views of members of the industries, questionnaires were drawn up, which were sent to some of them individually as well as to the Trade Associations where they exist and to Provincial Directors of Industries. Written replies were obtained from some. A number of industrialists and Directors of Industries were also requested to appear before the Panel for oral evidence, some of whom responded and furnished the Panel with valuable information and views. In most cases the Directors of Industries sent their technical officers to give oral evidence. The questionnaires had to be different for the principal centres of production due to differences in their conditions of production. The questionnaires and records of replies have been submitted to the Government of India in a separate volume along with the report.

Visits to Industrial Concerns

5. To get first-hand information on the working conditions, plants, and varieties and standards of products manufactured, the members of the Panel visited a number of tanneries, shoe factories and other leather goods manufacturing concerns at the centres where they held meetings. The Panel offers its thanks to the management of those concerns for the courtesy extended and trouble taken in showing the members round and explaining the processes. A list of the concerns visited is given in Appendix II.

6. The Panel now begs to submit the following report to the Government of India through the Industrial Adviser

Sd/-B. M. Das (Chairman).

Members:
Jamal Moideen
P. S. Chaudhury
M. Balasundaram Naidu
A. C. Inskip
S. K. Sen
Bool Chand
P. S. Pandit
H. Raney
Kaiser Ahmed

A. K. Datta, *Secretary*.
April. 1947

CHAPTER II

Background

7. Tanning and shoe and leather goods making are very old crafts in India which have been practised by the traditional leather working classes, the *chamars* and *mochis*, since time immemorial. Those classes belong to the depressed communities and the bulk of them are uneducated and poor. But the age-long practice handed down from father to son over several generations has enabled them to evolve techniques of their own by which they turn out even to-day large quantities of tanned leather, footwear and leather goods for home and export markets.

8. In leather production these indigenous techniques are represented by (i) bag tanning of buffalo hides and also of appreciable quantities of cow hides all over India; (ii) the *nari* process of tanning by which the popular red shoe upper leather is produced from goat skins and the book binding leather known as "Kabuli Bheries" is made from sheep skins by the *Khaticks* in the Punjab and (iii) the South Indian process of tanning cow and light buffalo hides and sheep and goat skins for export.

9. In shoe and leather goods production, the indigenous techniques are represented by the innumerable types and varieties of indigenous footwear which are still popular in India and a number of varieties of leather goods, for instance Bhisti's water bag, leather jar for holding *ghee*, leather bucket for lifting water from wells, smithy bellows, leather shields, leather reins, leather-covered boxes, etc.

10. The indigenous techniques include the essential skilled and unskilled operations which are involved in modern advanced tanning, shoe and leather work and the Indian *chamars* and *mochis* are well versed in them. There are processes in leather, shoe and leather goods making which people of no other community except the *chamars* and *mochis* will agree to perform. Hence this community is the reservoir in India from which the supply of labour both skilled and unskilled, for this industry has been drawn. In the whole of India according to the census of 1931, there were 16,455,487 *chamars* and *mochis* whose distributions as amongst the provinces is shown in Appendix III. The *chamar* and *mochi* population in an area has an important bearing on the extent to which tanning and shoe and leather goods industries can be carried out there. The intelligentsia of the country do not appear to have taken any interest in these industries, and this fact has stood in the way of their development and progress.

11. For tanning, the *chamars* use the astringent-vegetable materials, mainly barks, fruits and leaves of trees from the forests and jungles in the neighbourhood and the tanning properties of a large number of these are known to them. Many of these indigenous tanning materials are only of local importance on account of the inadequacy of their supply and the unsatisfactory leather they produce. Three of them, however, *viz.*, *babul* bark, *avaram* bark and myrobalans have proved to be wider importance.

12. Western processes of vegetable tanning and currying were introduced in India as far back as 1857 by the British military authorities to make leather for military equipment. About the year 1867, the Government Harness and Saddlery Factory was established at Cawnpore. This factory has since then been tanning and currying harness leather and fabricating harness and saddlery and other military equipment for the Army in India.

13. Another important landmark in India's leather and shoe industries was the establishment of the tannery and shoe factory of Messrs. Cooper, Allen & Co. in 1881. This firm started tanning and manufacture of military footwear according to western methods by machinery. Later on, it started the manufacture of the western types of civilian shoes as well by machinery.

14. A few tanneries were later on started at Cawnpore, chiefly by hide dealers, with the object of tanning the limed hides rejected by the Government Harness and Saddlery Factory. These tanneries followed the western vegetable tanning process carried out in pits in leached liquors. One of these, the Cawnpore Tannery started by Haji Halim made conspicuous progress and its vegetable tanned cow hides, coloured brown and black, were very popular in the Agra shoe industry till chrome upper leather replaced it completely. Shewan's tannery was also started about this time and its vegetable tanned leathers enjoyed a reputation for quality. Cawnpore thus became a big centre of production for western types of leather and footwear.

15. Chrome tanning was introduced in Madras in 1903 by Sir (then Mr.) Alfred Chatterton. Mr. Chambers of Chrome Leather Coy., Madras, Dr. (later on Sir) Nilratan Sircar of the National Tannery, Calcutta, Mr. M. S. Das of Utkal Tannery, Cuttack and Mr. N. S. T. Chari of Mysore Tannery, Bangalore developed and expanded the chrome tanning industry in India. Other chrome tanneries were started in Calcutta, Cawnpore, Madras and Bombay, after the world war in the twenties. Messrs. Bata Shoe Co., Ltd., came into the field in the thirties.

CHAPTER III
India's Resources of Raw Hides and Skins

16. Hides and skins are the essential raw materials of leather and leather goods industries and they are mainly derived from buffaloes, cows, goats and sheep. It is apprehended that during the war, the livestock resources of India have been considerably depleted. A fresh census of livestock should, therefore, be taken. Before the war, India used to derive from its livestock, the following quantities of hides and skins annually:—

TABLE I

Buffalo hides	57 lakh pieces
Cow hides (usually known as kips)	200 " "
Goat skins	275 " "
Sheep skins	171 " "

17. The Hides Cess Enquiry Committee reporting in 1930, estimated the total value of hides and skins produced in India at Rs. 18¾ crores while the reports on the marketing of hides and of skins published by the Government of India in 1943 put the value at Rs. 9·64 crores.

18. The production of hides and skins in the different British Indian provinces and the Indian States is shown in Table II below:—

TABLE II

Annual production in lakh pieces

Place of origin	Buffalo hides	Cow hides or kips	Goat skins	Sheep skins
1	2	3	4	5
Kashmir State	...	1·8	3·1	4·6
N.-W. F. P.	1·8	2·4	5·7	5·3
Punjab	4·9	9·4	18·7	16·1
Rajputana States	1·9	6·6	21·3	13·7

1	2	3	4	5
Central India	0·7	2·8	4·7	0·6
Sind	0·4	1·7	6·3	1·9
Kathiawar, Gujrat and Baroda States	1·3	2·8	7·4	5·5
Bombay Province and States	2·7	8·9	18·8	18·0
Mysore States	0·8	3·4	3·3	5·7
Travancore	...	2 0	0 6	1·3
Madras Province	15·1	38·6	19·9	39·9
Hyderabad State	2·2	13·2	16·3	17 1
Central Provinces	6·4	12·9	11·3	1·3
Eastern & Central Provinces and States.	3·0	4·7	7·1	1·8
United Provinces and States	5·6	16·0	53·2	17·0
Bihar	5·2	16·5	28·8	3·0
Orissa	0·6	5·3	3 3	0·8
Bengal	1·7	43·2	29·6	3·5
Assam	0·4	4·3	1 5	...
Other Areas	2·4	3·6	14·0	13 7
Total India	57·1	200·1	274·9	170·8

19. It will be seen that as regards cattle hides, Bengal and Madras are pre-eminently the largest producing provinces, each being responsible for the production of nearly a fifth of the total in India. In buffalo hides, Madras is the largest producer and contributes about a fourth of the total. In goat skins, U.P. is the largest producer and contributes about a fifth of the total. It is followed by Bengal and Bihar, each contributing about a ninth of the total.

Characteristics of Indian Hides and Skins

20 *Buffalo hides.*—These are large, thick and usually heavy in weights in comparison with cow hides. In India, they are used for making such heavy leathers as sole, harness, belting, picking band, etc. The largest use, however, is for making sole leather. Buffalo hides vary in characteristics according to their province or origin. Those of the N.-W.F.P., the Punjab and Delhi are usually heavier than the buffalo hides of the areas in south. U.P. buffalo hides have a good and clean grain and are spready but not quite so thick as those of the Punjab. The better grades of them are suitable for harness leather. C.P. buffalo hides are fairly heavy and suitable for sole and those of Madras are mostly light and many of them are not quite suitable for sole leather. The bulk of these are lightly tanned along with cow hides in South Indian tanneries and exported as East India tanned kips. About 25 per cent. of the Indian buffalo hides are derived from slaughtered animals and the rest from the naturally dead stock.

21. *Cow hides or kips.*—Compared to cattle hides of Europe and America, these are lighter, thinner and smaller in size. They are very suitable for making leather for shoe uppers, lining, etc. Better grades of them having sound grain and good substance are suitable for chrome tanning, while the others are vegetable tanned. Like buffalo hides, about 25 per cent. of the cow hides are derived from slaughtered animals and the balance from the fallen stock. They have several defects which greatly reduce their value and utility for making good leather. The most prevalent among the defects are warbles, holes, tick and pock marks, brands and flay cuts and scores. The incidence of the defects and other characteristics vary from province to province.

22. Cow hides of the Punjab and N.-W.F.P. are comparatively large and heavy and are not suitable for making chrome upper leather of good quality. About cent. per cent. of the N.-W.F.P. and 50 per cent. of the Punjab cow hides are from slaughter animals. Some of the U.P. cow hides are also heavy but quite a large number of them are of medium weight, substance and size. These latter, derived specially from Bareilly, Rampur, Moradabad, Lucknow, Agra, Muttra, etc. are the best cow hides in the whole of India for making high class chrome upper leather. Hides of these districts and others lying in the west of Cawnpore, known as *pacham* hides are in great demand from chrome tanners in all parts of India.

23. Bihar hides derived from Dinapore, Durbhanga and Muzaffarpur are mostly of medium size, substance and weight and are suitable for chrome upper leather. Bengal cow hides are mostly small size, light weight and poor substance. A large proportion is tick infested and bears pock marks. A great bulk of the Bengal cow hides is eagerly bought by Madras tanners because they are particularly suitable for making tanned E.I. kips light weight and even substance which fetch a higher price in U.K. than those tanned kips which are heavy and butty.

24. *Goat Skins.* Their characteristics very widely with the region of origin. Thus, goat skins of the N.-W.F.P., the Punjab, Sind and Kathiawar are large, heavy and coarse grained. They are suitable for bark tanning to make Morocco and other varieties of vegetable tanned light leather where smoothness of grain is not essential. They are not suitable for making high class glazed kid by chrome tanning. Those of U.P. and Deccan are somewhat smaller and lighter than the Punjab skins but are medium grained and are not quite suitable for high class glazed kid.

25. Goat skins of North Bihar and Bengal are small, light and of fine grain. Some of the skins of these provinces, *viz.*, *Muzaffarpores*, *Daccas*, *Dinajpores* and *Kusthias* are recognised in the United States of America as the best raw material for high class glazed kid.

26. *Sheep Skins.*—These also vary widely in characteristics from province to province. The skins of the Punjab are comparatively large and heavy, of loose texture and poor quality. Those of U.P. and Rajputana are similar to the Punjab skins. The sheep skins of Orissa are small and of good quality and those of Madras, specially the hairy sheep skins, are the best in texture, producing tight grained leather.

27. The most outstanding characteristics of Indian sheep skins is their low fat content compared to the sheep skins of other countries. On account of this, Indian sheep skins after tanning can be dyed and finished without degreasing. Sheep skins of other countries are usually so fatty that unless they are degreased, they cannot be satisfactorily dyed and glazed.

Defects of Indian Hides and Skins.

28. The defects of the Indian hides and skins are due principally to the following causes:—

(i) The generally inferior breeds of livestock,

(ii) Malnutrition of the animals in many cases,

(iii) Maltreatment of the animals like branding and striking with sharply pointed goading sticks,

(iv) Animal diseases,

(v) The prevalent practice of allowing the cattle to linger on till old age,

(vi) Negligent flaying, producing cuts and scores in hides and skins,

(vii) Infestation by animal pests like warbles, ticks etc., and

(viii) Defective curing for preservation.

29. The Hide Cess Enquiry Committee appointed by the Government of India in 1929 dealt thoroughly with these defects and made specific recommendations for their remedy. In the Committee's view, many of the defects can either be minimised or entirely eliminated by reasearch and educative propaganda which, as the Committee recommended, the Government should undertake because the defects have been causing an annual loss of 3 to 4 crores of rupees to India. The defects are also responsible for the difficulty experienced by the Indian tanning and leather industries in improving the standards of quality of their products. The most prevalent of these defects which cause great damage, is the infestation of cattle hides by warbles and ticks. Research on these has been going on for some time at the Imperial Veterinary Research Institute at Mukteswar. The results of these researches deserve to be applied on a large scale throughout the country to free Indian livestock from these two damaging pests.

29a. Another conspicuous defect is bad flaying of hides and skins, derived both from slaughtered and naturally dead animals. Flaying in the organised slaughter houses already existing in the country should be improved by better equipment of the slaughter houses and licensing the flayers. Facilities for training flayers should be set up in different provinces. For the improvement of flaying of naturally dead animals, the trained flayers should be employed in Rural Union Board centres and village *chamars* who do the flaying at present should receive training from them. The *chamars* should be organised into co-operative societies to facilitate proper flaying and marketing of hides and other products from the carcass.

Import of Raw Hides and Skins into India.

30. Normally India imports a small quantity of raw hides and skins, mostly over land frontier routes and they are usually of poor quality. In the quinquennium ending 1938-39, the average annual imports were 10 lakh pieces of hides and 53 lakh pieces of skins. The proportions of buffalo and of cow hides and those of goat and of sheep skins are not shown in the import statistics but one would not be far out, if these were taken to be roughly in equal proportions. Including imports, raw hides and skins available in India just before the war are approximately represented in table III below:—

TABLE III.

(In lakh pieces)

Description	Indian Production	Import	Total
Cattle hides	200	5	205
Baffalo hides	57	5	62
Goat skins	275	26·5	301·5 (say, 300)
Sheep skins	171	26·5	197·5 (say, 200)

Export of India's raw hides and skins

31. On account of their abundant supply and desirable characteristics, Indian hides and skins attracted the attention of tanners in Europe and America over a hundred years ago. In case of hides, the volume of this export trade progressively increased with occasional fluctuations due to famines upto the year 1913-14 when the first world war broke out. After that it declined steadily and lower prices per piece of the exported hide were realised. This is shown in Table IV below:—

TABLE IV.

Export of raw hides from India and Burma.*

(In lakh pieces)

Quinquennium ending	Average annual export of kips	Value per piece		Average annual export of buffalo hides	Value per piece	
		Rs.	As		Rs.	As.
1913—14	92·6	6	6	28·9	7	3
1918—19	55·2	6	11	13·4	8	5
1923—24	55·5	5	0	8·7	5	6
1928—29	60·4	4	11	10·3	4	9
1933—34	37·4	3	1	5·3	3	14
1938—39	46·1	2	6	6·2	2	15

(Report on the Marketing of Hides: pages 30 and 34).

*Although figures for Burma are included, they do not much effect figures for India as the former are comparatively small.

32. Export of raw goat and sheep skins, however, did not decline as is shown in Table V taken from *Report on the Marketing of Skins*, pages, 19 and 22.

TABLE V.

Export of raw skins (goat and sheep) from India.

Period	Annual export of goat skins in lakh pieces	Value per piece		Annual export of sheep skins in lakh pieces	Value per piece	
Quinquennium		Rs.	As.		Rs.	As.
1920-21—1924-25	235 5.	1	8	10·6	1	1
1925-26—1929-30	255·0	1	11	8·3	0	15
1930-31—1934-35	209·7	1	3	14·2	0	11
YEAR ENDING:—						
1935—36	283·9	1	0	17·1	0	13
1936—37	251·6	1	2	11·3	1	5
1937—38	241·4	1	4	14·2	0	15
1938—39	239·4	1	1	13·2	0	12

33. The reason for the steady decline in the export of hides was the development of the hide tanning industry in India and the consequent increased consumption of hides by it during the period between the two world wars. Goat skin tanning, however, did not develop appreciably in India; consequently, the volume of export of goat skins remained more or less steady. The bulk of the available Indian sheep skins has been tanned in India since a long time. After meeting the requirements of the home market, only a small surplus which was available, used to be exported. This exportable surplus also remained steady during the period.

TABLE VI.

Disposal of the available hides and skins in India (about 1938-39).

Description	Total available (including) imports in lakh pieces	Tanned in India		Exported as raw	
		In lakh pieces	in percentage of total	In lakh pieces	in percentage of total
Buffalo hides . .	62	55·8	90	6·2	10
Cow hides (kips) .	205	158·9	77·5	46·1	22·5
Goat skins . . .	300	60·6	20	239·4	80
Sheep skins . .	200	186·8	93·5	13·2	6·5

34. Thus at the beginning of the last war, India was tanning practically all of her available buffalo hides and sheep skins, leaving a very small percentage for export as raw. She was also tanning more than three-fourths of her cow hides, leaving barely one fourth for export as raw. But the picture was different in the case of goat skins of which 80 per cent. was exported as raw, because goat skin tanning had not then developed in India.

35. *Export of raw hides and sheep skins is now unnecessary and prejudicial to the Indian Tanning Industry.*—If surpluses for export of raw hides and sheep skins were small before the war, they are considerably smaller now, because the tanning industry in India in all its sections has expanded further since then, due to the war impetus. Export of these hides and skins now will deprive the Indian tanning industry of its essential raw material because it now requires the whole of the available supply and as such export would be prejudicial to its vital interests. *Export should be stopped.* The producers of Indian hides and skins do not get a higher price from the exporters than from the tanners in India because there is very keen competition among the Indian tanners themselves. On the other hand, it is a definite economic gain to India as a whole to tan all its available hides and skins and *export the surplus leather.*

36. Taking the average of the values realised per piece of hide and skin from export as raw and as tanned, the following figures are obtained covering a very long period.

		Rs.	As.	P.
Average value received per piece of tanned hide exported	...	7	1	0
Average value received per piece of raw hide exported	...	4	9	0
Increased value received by India per piece of tanned hide exported	...	2	8	0
Average value received per piece of tanned skin exported	...	1	10	6
Average value received per piece of raw skin exported	...	1	3	10
Increased value received by India per piece of tanned skin exported	...	0	6	8
		(say 0	7	0)

37. Thus, the export of every piece of raw hide and skin means a loss of Rs. 2-8-0 and 0-7-0 respectively to India. Calculating on this basis, during the quinquennium ending 1938-39, India's total loss from exporting raw hides and sheep skins, which she could have most probably tanned before exporting, if they were retained in the country, amounted to Rs. 1,36,52,500 or in round figure Rs. 1½ crores annually.

38. In respect of goat skins, however, as the manufacture of glazed kid (which is the most suitable leather for which the fine grained goat skins of India should be utilised) had not developed, their export in the raw condition was unavoidable before the war. As glazed kid manufacture has not yet developed adequately in India, the export of finer types of goat skins will have to go on for sometime in the immediate future also. Vigorous attempt should be made for the development of the industry in this country. There is, however, no reason why the coarser types of goat skins which are unsuitable for glazed kid manufacture in Europe and America should have been exported as raw, rather than in the tanned condition. Export of goat skins should now be controlled and proportionately restricted as the manufacture of half-tanned goat skins and glazed kid increases according to the programme indicated in paras. 69 and 94. According to this, the export of goat skins should now be restricted as under:

(1) immediately by 42.5 per cent. (of the pre-war export of about 240 lakhs) of which 72 lakhs would be coarse-grained and 30 lakhs fine grained;

(2) after the first five-year period, by 55 per cent. that is to say, 72 lakhs coarse-grained *plus* 60 lakh fine grained; and

(3) after ten years by 72 per cent. that is to say, 72 lakh coarse-grained *plus* 100 lakh fine-grained.

Curing and Preservation.

39. Raw hides and skins are cured for preservation in India by wet salting with common salt, dry salting with either *khari* salt alone or a mixture of *khari* and common salt and by air drying either stretched on frame or simply by spreading on the ground. As it is desirable that hides should no longer be exported dry and dry salt curing should also be stopped in the interest of the Indian tanning industry, only goat skins for export may continue to be dry salted as at present. To facilitate wet salt curing even by the village *chamar* and small butcher, denatured salt should be made available widely in rural areas and the present restrictions in the way of securing its supply should be relaxed. The salt Department should arrange with its authorised agents to carry stocks of denatured salt and sell it to hide and skin curers and to make the agents themselves responsible for keeping the necessary accounts rather than the illiterate *chamar* or the butcher (*Report on the Marketing of Hides* page 73.) The Railways should provide wooden wagons for the transport of wet salted hides to keep them cool during transit. Again, raw hides and skins should be treated as perishable goods and their quicker transport arranged. Mr. S. K. Sen a member of the Panel drew its attention to a new curing process recently developed in Argentine by a Company, Accel Argentina S. R. Ltd. The process is called Accel Process by which hides and skins are dehaired, bated and conserved by drying for export. All these operations are carried out in drums and for drying quickly infra red lamps can be used. Sun drying can also be done. The process has been patented by the above firm and persons in India interested in the process may correspond with it.

Summary of Recommendations.

40. (i) A fresh livestock census should be taken as soon as possible,

(ii) Statistics of available hides and skins in India should be brought up-to-date without delay,

(iii) Warbles should be exterminated by an organised campaign of treating the cattle in the affected areas with Derris Dressing,

(iv) Ticks should be exterminated from the affected areas, chiefly Bengal, Orissa, Madras, Bombay and Assam by an organised campaign of dipping the cattle in tickicidal solutions or by spraying the solution on the cattle,

It is realised that extermination of these widely prevalent pests will take a long time. But the Panel's recommendation is that a start in this work should be made forthwith.

(v) Research on warbles and ticks should be carried out on a more extended scale than is being done now,

(vi) Flaying should be improved by:—

(a) Setting up well-equipped slaughter houses in cities, towns, subdivisions and centres of village unions and causing them to be worked under the supervision of Veterinary Officers,

(b) Introducing suitable safety flaying knives,

(c) By training flayers in the correct method of work and licensing the flayers of the slaughter houses. The licence should be subject to cancellation for continued bad work, and

(d) The *chamars* should be organised into co-operative societies to facilitate proper flaying and marketing of hides and other products from the carcass.

(vii) Branding of cattle should be stopped by legislative measure.

(viii) The Cruelty towards Animals Act should be extended to rural areas to prevent the maltreatment of animals and damaging of hides with sharp goading sticks.

(ix) The damage to hides and skins caused by animal diseases should be minimised as far as possible by greater veterinary care and attention.

(x) The breeds of Indian livestock should be improved by setting up Government Stock Breeding Farms in the different provinces,

(xi) Adequate pasture lands and fodder should be provided for the livestock,

(xii) Dry and dry salt curing for hides and sheep skins should as far as possible be discontinued and wet salting substituted and for this denatured salt should be made available to hide and skin curers with facility unimpeded by restrictions of the Salt Department. Specifications for wet salted hides should be formulated and introduced in the hide trade,

(xiii) To prevent damage to wet salted hides and skins from heating during their transport, wooden wagons should be provided by the Railway,

(xiv) Inter-Provincial traffic in raw hides and skins in India should be restored forthwith to its pre-war freedom,

(xv) The war-time practice of issuing priority certificates for wagons should be abolished and until total abolition is possible, hides and skins should be placed on a higher priority and they should be classified as perishable goods for Railway transport.

(xvi) Export of cow and buffalo hides and sheep skins should be prohibited. To meet the needs of the Indian tanning industry, export of goat skins should be restricted by 42.5 per cent. of pre-war export immediately and by 55 per cent, and 72 per cent. after five and ten years respectively.

CHAPTER IV.

Vegetable Tanning Materials.

41. It has been stated above (Para. 11) that many vegetable materials are known to the Indian *chamars* and used by them in their tanning processes. There are hundreds of such tanstuffs found in different parts of India. A recent publication of the Forest Research Institute, Dehra Dun (Indian Forest leaflet No. 72, 194) describes 300 of these. The indigenous tanstuffs which had been used in India in large scale tanning for the production of more or less standard types of leather, are the bark of *babul* (*Acacia arabica*), bark of *Avaram* (*Cassia auriculata* and *myrobalans* (Fruits of *Terminalia chebula*). *Babul* bark has been the principal tanning material in Northern India, from the Punjab to Bengal, since a long time, used alike by the rural tanning industry and the large organised tanneries at Cawnpore. Agra and Calcutta. Blended with myrobalans in suitable proportions and properly adjusting the pH of the tan-liquor, it produces an excellent sole leather from buffalo hides and equally good harness leather from buffalo and cow hides. For about 80 years, the Cawnpore tanneries have used it for making these leathers with entire satisfaction. The bark was obtained by them from trees in areas close to Cawnpore and as the felled trees have not been replaced and also as the tanning industry has expanded, Cawnpore's demand for *babul* bark is now far in excess of the supply. The shortage of *babul* bark has been made up by the bark of wattle (Acacia mollissima wild, black wattle) imported from South Africa. The larger tanneries in Calcutta adopted wattle bark several years before the last war. Wattle bark has thus practically replaced *babul* bark in the organised tanning industry of Northern India. The small scale cottage tanners known as bag tanners are, however, still using *babul* bark. Some of the bag tanners in Calcutta are using wattle bark to some extent and they would use more if they could get the supply. It thus looks as if *babul* bark would be entirely replaced by wattle in North Indian tanneries as soon as the present restriction on its import is lifted.

Avaram.

42. In South India and Bombay Presidency, the bark of *avarami* was the principal tanning material for a long time and was used for tanning both hides and skins to produce the tanned E.I. kips and goat and sheep skins for the export trade. *Avaram* bark has properties which make it specially suitable for the production of these types of leather Its tannin, even in very weak solution,

penetrates the pelt quickly and combining with the fibres loosely, produces a soft leather of an agreeable light cream colour. The curriers and leather dressers in the U.K. and elsewhere in Europe liked the *avaram* tanned kips and skins on account of their agreeable colour and soft and kindly feel and particularly because they could easily strip these leathers of their feebly combined tannin and give them a retannage with either chrome or tanning extracts to make semi-chrome or substantial vegetable tanned leather for various purposes. But with the expansion of the export leather tanning industry, the so-called "half tanning" industry in South India, the supply of *avaram* bark from the existing forest resources with available labour for collection and stripping of the bark, fell short of the mounting demand. Wattle bark was at first imported from South Africa in 1923 and experiments were done with it in tanning hides. Eventually difficulties were solved and wattle was successfully introduced in the Madras kip tanning industry where *avaram* has been entirely replaced by it. In skin tanning, however, *avaram* is still used but in the course of the Panel's tour in South India, report was received that experiments had been in progress with the object of replacing *avaram* with wattle in skin tannage also.

43. The difficulties with *avaram* are that (a) the forests where the plants occur in such dense growth as to make the collection of bark worthwhile are often far away from the tanning centres; (b) the yield of bark is very low being less than 10 per cent. on the weight of the sticks so that a head load of sticks produces only 4 or 5 lbs. of dry bark; (c) the sticks from which the bark is stripped being very narrow, generally about 3/4 inch in diameter and never exceeding 1½", stripping becomes laborious; and (d) as the leaves and twigs of *avaram* are largely used by agriculturists as green manure, a large percentage of the available supply is lost to the tanning industry. All these factors have tended to reduce the supply and raise the price of this very desirable tanning material to an uneconomical level so that eventually it had to be discarded in favour of wattle in hide tanning and is being threatened to be replaced by wattle in skin tannage as well.

Wattle Bark.

44. The position in India now is that two of its well established vegetable tanstuffs have been practically discarded in favour of the important wattle bark because the latter is stronger in tannin contents, reliable in quality, available in adequate quantity in neatly packed and pressed bales and produces quite satisfactory leather. Ever since 1923, the import of South African wattle into India has been increasing as the following table shows:—

TABLE IX

(Figures for quantity and value in lakhs)

Quinquennium ending	Quantity	Value
	Cwt.	Rs.
1918-19	...	...
1923-24	0·24	1·18
1928-29	1·41	12·11
1933-34	2·28	14·30
1938-39	3·54	17·94

45. Wattle bark has come to stay in the Indian tanning industry and is gaining in popularity. To make India self-sufficient in its essential vegetable tanstuffs, it is necessary to establish wattle plantations as has been done in South Africa and Kenya. In South Africa about half a million acres of land were under wattle and the total value of bark and extract produced was Rs. 2½ crores in 1937. Experiments have proved that black wattle (*Acacia mollissima*) can be successfully planted in South India. Plantations on the Nilgiris, Palins and Kodaikanal have been successful. The Forest Department, Madras has adopted a scheme to increase wattle plantation in the province. The Forest Department may also investigate the possibilities of introduction of large scale wattle plantation in Orissa, C.P., Assam and other suitable provinces.

46. In oredr to make India self-sufficient in respect of vegetable tanstuffs it may be thought desirable to attempt to reintroduce *babul* and *avaram* bark but the prospect is not at all bright. Firstly, those who have become used to the stronger and neater wattle, would not revert to *babul* or *avaram;* and secondly, it would hardly be possible for *babul* and *avaram* barks to complete successfully with wattle bark in price per unit of tannin. But it is worth while to keep these two tanning materials as a stay-by in case foreign supply of wattle is cut off for the organised tanning industry, and also to meet the demand of the bag tanners of Northern India who still use *babul* bark on a large scale, and the skin tanners of South India who still use *avaram* bark for tanning skins. Suitable regions for the growth of *babul* appear to be Sind, Punjab, U.P. and C.P. and those for that of *avaram* are southern and western India and Rajputana where the possibilities of their commercial plantation should be investigated by the Forest or Agricultural Department or by both.

Plantation of sumach (Rhus coriaria).

47. As India does not as yet possess a satisfactory tanning material like sumach, a great deal difficulty is being experienced in developing the light leather tanning industry in the country. Attempts should be made to plant sumach in India.

Tanning Extracts.

48. Use of these is increasing in the Indian tanning industry and the demand is being met chiefly by the import of Mimosa extract *i.e.*, the extract of wattle bark, from South Africa. India produces in its two tanning extract factories, one at Raniganj and the other at Kharagpur, certain quantities of myrobalan extract. Before the war, the bulk of the extract used to be exported. As myrobalan extract cannot be used alone in extract tannage, the production of this only, cannot make India self-sufficient in tanning extract. It is very necessary that an industry for the manufacture of extracts from suitable indigenous tanstuffs should be established in India. Likely materials are *babul* bark, *avaram* bark and mangrove bark, specially the bark of goran (*Ceriops roxburghiana* of the Sunderbans, Bengal). The most suitable place for the establishment of an extract factory for the production of Mangrove extract is Sundarbans in Bengal where its possibilities and prospects should be investigated. Similarly, Sind, Punjab and U.P. are suitable places for the manufacture of *babul* bark extract and possibilities and prospects of establishing a *babul* bark extract factory in each of these places should be studied. The existing resources of *babul* trees and possibilities of their commercial plantation in U.P. should be surveyed. If adequate supply of *babul* bark proves forthcoming, a plant for the manufacture of *babul* bark extract may then be added to the myrobalan extract factory recommended below for C.P. An increase in the manufacture of myrobalan extracts in India is feasible. But the output will have to be sold in export markets. If sufficient market is available, an increase

in the production of myrobalan extracts may be made in India by establishing more extract factories in addition to the two which are already in existence. Most suitable places for them appear to be C.P. and Orissa, specially the former province, where myrobalan resources are adequate. In manufacturing all tanning extracts, the most up-to-date plant capable of producing extract in dry powder form by using the modern spray driers which are in extensive use at present in Germany, England and America, should be employed. The old form of solid extract in lumps is getting obsolete in Europe and America.

49. In Europe tanning extract has been manufactured from sulphite cellulose liquor which is a waste of paper mills. As paper mills are growing in number in India, attempts should be made to utilise their waste liquors in a similar way for the Indian tanning industry, if possible. Much, of course, depends upon the species of wood used in paper making.

Synthetic tannins (Syntans).

50. That India is short of commercially exploitable vegetable tanstuffs has been indicated in the report. An effective way of making good a part of this shortage is manufacture and use of synthetic tannins. In this India can follow the example of Germany. That country has practically two vegetable tanstuffs, pine and oak barks, both in short supply and of low tannin contents (about 10 per cent. tannin) which is not even as much as that of India's *babul* bark. According to BIOS Final Report No. 760, page 6, the total consumption of Germany in 1937 was 83,200 tons of tanstuff on pure tannin basis of which 16,000 tons were derived from syntans manufactured in Germany. During the war the production was further increased. The chemical factories of I.G. at Leverkusen, Ludwigshafen and Hochst are the principal manufacturers and the products are called Tanigans. In 1937 these three factories produced 10,000 tons. The production was increased to 50,000 tons in 1943. A great deal of information on the processes and plants for the manufacture of Tanigans, has been collected by technical investigators who had been to Germany for the purpose and has been published in their reports. These should be carefully studied by organic chemists in India and as technical investigators are still being sent to Germany a number of Indian Organic Chemists should go to Germany to study and collect first hand information on this important subject. With the knowledge they will acquire, it will be possible to start manufacturing synthetic tanning materials similar to tanigans, provided the necessary raw materials, namely the crude catechols, cresols, phenols and naphthalene obtained from coal tar distillation are available in India in required quantities. The present position of India in regard to these important Coal tar distillation products should be thoroughly investigated forthwith. The Panel draw particular attention of the Government of India to the very important subject of initiating the Manufacture of syntans in India and holds the view that the manufacture is possible if proper steps are taken at once. The matter brooks no delay. Manufacture of syntans has been started and going on for sometime already in U.S.A. and U.K. New plants are being further installed there. Production either in variety or volume, does not appear to have reached the level attained in Germany.

Summary of Recommendations.

51. (a) As the Panel views with great concern the increasing dependence of the India vegetable tanning industry on imported wattle bark, it strongly recommends that measures be taken up to introduce large scale wattle plantation in this country at once.

(b) To study the wattle plantation industry of South Africa, an expert delegation consisting of a sylviculturist, a soil expert and a tanner should be sent to Kenya or South Africa as soon as possible.

(c) The possibilities of *babul* and *avaram* plantations on a commercial scale should be thoroughly investigated.

(d) *Babul* trees should be planted in increasing number in forests and along irrigation canal banks. An intensive propaganda should be made by provincial and State Departments of Industries to prevent the wastage of *babul* bark by burning the timber as fuel without stripping the bark, with a view to conserve this valuable material for tanning. The Government should also arrange with the railways, facilities for the transport of *babul* bark from the producing to the consuming centres at reasonable freight rates.

(e) As India does not yet possess a satisfactory tanning material for light leather tanning, the possibility of growing sumach (Rhus coriaria) in India should be thoroughly investigated.

(f) Attempts should be made to establish a tanning extract industry in India and with a view to do this, investigation on indigenous tanstuffs should be made and experiments to manufacture extract from suitable tanning materials *e.g.*, *babul* and *goran* barks and other Indian tanning materials in pilot plants should be carried out. A few students should be sent abroad, preferably to U.S.A., with scholarship to learn the techinque of extract manufacture.

(g) Attempts should be made to manufacture sulphite cellulose extract from the waste liquor from paper mills.

(h) Research should be carried out to make synthetic tannins in India. Indian Organic Chemists should study reports on German tanigans and some of them should be sent to Germany to study the technique of Tanigan products and get first hand knowledge of process and plant.

(i) A survey of the position in India of the raw materials, *viz.*, such coal tar distillation products as crude catechols, cresols, phenols and naphthalene, regarding their quality and available quantity, should be made.

CHAPTER V

The Indian Tanning Industry.

52. The Indian Tanning Industry may be conveniently divided into three section. *viz.*, Vegetable or Bark Tanning, Chrome Tanning and Miscellaneous Tanning. The types of leather produced under each are mentioned below:—

I. Vegetable or Bark Tanning.

(i) Bag tanned leather.
(ii) Tanned E. I. kips, goat and sheep skins.
(iii) Pit tanned heavy leathers, *e.g.*, sole, harness, and belting.
(iv) Pit tanned dressing leather.
(v) Pit tanned Patent Leather (Hood varnish).
(vi) Pit tanned light leather.

II. Chrome Tanning.

(vii) Box and willow sides, kips and calf.
(viii) Glazed kid.
(ix) Chrome suede and imitation sambar.
(x) Chrome lining.
(xi) Neobuck leather.
(xii) Chrome patent.
(xiii) Chrome picking bands.
(xiv) Chrome lace.

III. Miscellaneous Tanning.

(xv) Alum tanned leather.

(xvi) Formaldehyde and oil tanned leather chamois.

53. Of the above mentioned varieties (i), (ii), (iii), (vii), and (viii) constitute the bulk of the production of the entire industry and they are grouped in this report under the head Major Types and the rest under Minor Types.

MAJOR TYPES.

(i) **Bag Tanned Leather:**

54. It is a vegetable tanned crust leather produced by *chamars* by the indigenous methods of tanning commonly known as bag tanning.

It is done practically all over India by the *chamars* but it is more concentrated in the Punjab where 5,000 to 6,000 *chamars* are reported to be engaged in it. The most conspicuous centre in the Punjab is the area round about Jullundur. Appreciable quantities of bag tanned leather are also produced in Lahore, Multan, Sialkot, Wazirabad, Shahabad, and Karnal.

55. In normal time, according to the Report on the Marketing of Hides, the *chamars* tanned annually 91 lakh pieces of buffalo and cow hides by the indigenous process of tanning, which is chiefly bag tanning. The value of bag tanned leather before the war could be put at Rs. 3½ crores annually. During the recent war, bag tanners were very active, so much so that they made it very difficult for organised tanners (who were making leather for defence services by pit tanning under Government control) to get adequate quantities of buffalo hide.

56. **Post-war Target**:—As it is expected that shoe wearing habit will be more and more general in India, the demand for and fabrication of all types of footwear including the indigenous types will also increase correspondingly. An expansion of bag tanning during post-war years can, therefore, be reasonably expected. The most essential requirement for its expansion is to make a larger number of hides than hitherto available to the industry, by restricting export. Bag tanners have hitherto been working individually. It would be a great help to them if the advantages of co-operative purchase and sale were made available to them. There is considerable room for the improvement of the quality of bag tanned leather. The Peripatetic Tanning Demonstration Parties of the Department of Industries in the Punjab and Bombay are reported to have helped to effect appreciable improvement of the local bag tanned leather by giving technical guidance to bag tanners. As for target at the end of the first 5 post-war years, an increase of at least 5 per cent. in the output over the pre-war figure appears to be practicable. The pre-war output was 91 lakh pieces; so during the first 5 years, output of bag tanned leather should be increased by 4.5 lakh pieces. As raw hides are available in all the provinces and as it will be possible for deficit areas to get supply from surplus ones, bag tanning should be carried out in all the provinces to provide local *chamars* with work. Mr. H. Raney, one of the members of the Panel, considers the target of 5 per cent. increase as inadequate. But this target has been proposed as it is apprehended that sufficient raw buffalo hides may not be available during post-war years to enable bag tanners to tan more than that indicated by this target. The target, however, is meant as a minimum. If more hides are available and there is a market for the increased production of bag tanned leather, the cottage tanners will, of course, tan more.

Summary of Recommendations.

57. (i) The export of raw hides should be stopped.

(ii) Wherever possible, bag tanners should be organised and brought under co-operative societies by the Provincial Governments.

(iii) The bag tanners should be encouraged to improve their product by the Peripatetic Demonstration Parties of the Provincial Governments, who should give them technical help and guidance.

(iv) The output of bag tanned leather should be increased by at least 5 per cent. or 4·5 lakh pieces over the pre-war figures by the end of the first 5 years. The bag tanners should process inferior grades of hides to make cheap leather and bag tanning should be carried out more or less in all the provinces to provide work for the local *chamars*.

(ii) **Tanned E. I. kips, goat and sheep skins:**

58. These are lightly tanned kips, light buffalo hides and goat and sheep skins which are exported in large quantities. On account of the intrinsic value of these lightly tanned Indian hides and skins, demand for them from overseas markets has been steadily increasing during the past 70 years. The industry is chiefly located in Southern India. A certain quantity of E. I. tanned kips is also produced in Orissa which is sent to Madras for sale, and eventually exported. Although, the industry is practically confined to South India and the latter tans all its kips, buffalo hides and sheep skins, and also a portion of its goat skins, it has to import large quantities of kips and sheep and goat skins from the Punjab, U. P., Bihar and Bengal to supplement its own supply of raw hides and skins in order to meet the export demand for these leathers. During the quinquennium ending 1938-39, India was exporting on an average the following quantities of the different types of E.I. tanned leather.

TABLE X

Export of E. I. tanned leather.

Type of leather	Quantity (in lakh pieces)	Value (Rs. in lakhs)
E. I. tanned hides	48	258
E. I. tanned skins	172·8	304·6

59. The main reason why E. I. kip tanning developed in South India is the availability of the vegetable tanstuff *avaram* which has suitable properties as explained in Chapter IV. Up to about 1921-22, this tanning material blended with a certain proportion of another local tanstuff, *Konam*, (*Cassia fistula*) was used. It has already been stated that *avaram* has now been replaced by South Africa wattle in kip tannage but is still retained in skin tanning.

60. **Volume and value of production.**—On an average during the quinquennium ending 1938-39, the total production may be taken to be as follows:—

TABLE XI

Description of leather	Exported		Retained for domestic consumption		Total production	
	Number	Value	Number	Value	Number	Value
	lakhs	Rs. in lakhs	lakhs	Rs. in lakhs	lakhs	Rs. in lakhs
1. Hides including kips & buffaloes	48	258	38	152	86	410
2. Sheep & goat .	172	304	18	22	190	327

Total Rs. 737 lakhs.

61. The E. I. kip and skin tanning industry thus represented a production of leather worth Rs 7.37 crores annually (pre-war).

62. **Effect of the War.**—During the war, production suffered considerably due to lack of hides and skins which could not be transported to South India on account of transport difficulties and also because Northern India (principally Cawnpore and Calcutta) tanned more hides during the war than they used to do before it. Mr. Malvenan in his note to the Panel has given figures showing that during the five years from 1935 to 1939, the average monthly export of tanned kips including cow and buff calf and buffalo hides was 5,100 bales from Madras port and it reached the peak figure 7,000 bales monthly in 1939. This is equivalent to about 70 to 80 lakh pieces per annum. During the decade 1925-35, this average was only 3,000 bales. The phenomenal increase from 3,000 to 7,000 bales shows what the Madras hide tanning industry can do if there is sufficient demand and if it gets the hides required. Due to lack of hides, many hide tanneries in South India lay idle during the war. At the time of the Panel's visit to Madras, it actually found the pits of a couple of tanneries it visited, lying more or less empty. According to figures given by Mr. Malvenan, H. M. G.'s purchase of E. I. tanned kips for export to U. K. in 11 months from June 1944 to April 1945 was a little over 1,700 bales monthly. It is estimated, Mr. Malvenan continues, that an equal quantity was tanned and sold to the civilian trade, making a total output of 3500 bales monthly. This is a 50 per cent. reduction on 1939 export to U.K.

63. Skin tanning in Madras, according to Mr. Moideen, one of the members of the Panel, has considerably suffered during the war and is still suffering. Mr. Moideen reports that E. I. tanned skins were one of the very first commodities to be brought under control at the very commencement of the war. Their export to any other country except U.K. and U. S. A. had been prohibited till April 1946. Since then the restrictions have been relaxed to some extent. They are generally shipped under two categories, viz., C. I. F. and consignment marks. The former consist of medium and inferior tannages while the latter are of superior and superfine tannages. The export of the former is permissible to U. K., U. S. A. and other permissible destinations. While that of the latter is confined to the U. K. only. Ceiling prices for tanned skins for both C. I. F. and consignment marks were fixed in U. K. and U. S. A. at par with pre-war prices and in some cases only 20 per cent. above pre-war prices, while prices of other commodities have gone up to about 250 per cent. above pre-war level. In June 1946, U. K. gave an enhancement of 20 per cent. on the ceiling prices, which was followed by U. S. A. also but as the law regulating controlled prices in U. S. A. lapsed at the end of June 1946, the prices of E. I. tanned skins rose by another 80 to 100 per cent. and U. S. A. was the chief operator in the market. Subsequently, due to some arrangement or some other cause, U. S. A. has gone out of the market completely and U. K. being the sole purchaser, has pulled down the ceiling prices in level with those which existed before June 1946. Prices of consignment goods are fixed by a Valuation Committee set up in England representing the purchasing interests only and then the goods are distributed to curriers, etc., by the said committee under a different name as Allocation Committee. In order not to injure the interests of the London brokers the consignment marks are not being allowed to be exported against direct sales on C. I. F. basis. Thus the industry was compelled to send skins of superior and superfine tannages also under C. I. F. marks which usually consist of medium and inferior class tannages, to escape from the Valuation or the Allocation Committee. From the middle of 1946, the Leather Control in U. K. have been assuring a hundred per cent. increase over the ceiling prices which existed upto June 1946 on all consignment goods. This attracted more shipments on consignment basis. This assurance was extended for goods shipped

by the 15th of January, 1947. But some goods which were ready but could not be shipped by that date due to lack of shipping space, have been shipped by steamer till the end of January, 1947. The Leather Control at London have been giving the trade to understand that all such goods will be included in the 100 per cent. scheme. But since then they have enunciated a new theory that the valuation committee would determine their values in keeping with the assurances, but that they could not find buyers at that level of prices. In all fairness, it should be obligatory on the Leather Control to obtain values in keeping with the assurances given before the time of shipping. Ceiling prices have been fixed in U. K. for raw sheep skins but they work out at a higher level than ceiling for tanned sheep skins. The Madras skin tanners who have to sell the tanned skins at their ceiling price in U. K. or U. S. A. cannot afford to pay for the raw sheep skins in India as much as U. S. A. was paying for them till the prohibition was imposed on the export of raw and pickled sheep skins in October 1946. The result was that pickled and raw hair sheep skins were being exported in increasing quantities to the injury of the Madras skin tanners. To preserve this age-old and established industry and to save it from further deterioration, it is necessary, firstly, to abolish forthwith all restrictions on the export of its products and their ceiling prices in U. K. and U. S. A.; secondly, to continue the prohibition imposed in October, 1946, on the export of pickled and raw hair sheep skins altogether and restrict that of goat skins according to the schedule given in para. 38; and thirdly, to afford transport facilities to move raw skins to tanning centres and tanned skins to internal markets by placing the railway transport of these goods on Class I priority.

64. To stimulate the production and export to U. K. of Madras tanned kips, H. M. G.'s purchasing Agency at Madras has introduced a bonus scheme since 1st August 1945. The bonus is paid to the kip tanners of South India over the scheduled prices according to the following rates:—

If in any month the purchases are:—

(a) 1,500 to 1,999 bales, a bonus of 2 annas per pound.

(b) 2,000 to 2,499 bales, a bonus of 4 annas per pound.

(c) 2,500 to 2,999 bales, a bonus of 5½ annas per pound.

(d) 3,000 bales or above, a bonus of 7 annas per pound.

65. As an effect of this scheme, the export of tanned kips including cow and buff calf has risen from 1,432 bales in 1945 to 4,781 bales in March 1946. A bale consists of 600 lbs. and weight ranges of tanned kips exported are 4-4½, 5-5½, 7-7½, 8-8½, and 10-12 lbs. The bonus that is being paid to Madras tanners does not, it is reported, affect the price at which the British curriers buy them, which is much lower than the price (inclusive of bonus) at which H. M. G. is buying at Madras. The excess in the shape of bonus is a subsidy by H. M. G. to the British manufacturers.

66. **Prospects of Post-war Expansion.**—Judging from the steady increase in the production and export of E. I. tanned leather during the period between the two world wars, the proved elasticity of the South Indian tanning industry for increased production and the keenness which is being shown by U. K. to purchase the leather, the Panel is definitely of the opinion that the E. I. tanning industry should be expanded substantially during the post-war period, specially during the first 5 years, to take advantage of the present keen demand. The *sine qua non* for this expansion, however, is that the industry should get adequate supply of raw hides and skins and of tan bark "wattle". Export of raw hides and skins should be restricted and plantation of wattle, which has already been initiated in South India, should be proceeded with, in right earnest and rapidly expanded. Exporters of raw hides and skins are inclined to be-little the importance of the E. I. tanning industry of South India. But it is too big an industry now in which the interests of the two

most important countries of the British empire, India and U. K. are concerned.

67. During the course of the Panel's investigation, it was reported that labour was running short in the E. I. kip and skin tanning industry. Some of the work at present done by manual labour can with advantage be done by machinery. Facilities should be given to the industry for their importation.

68. **Target.**—During the first 5 years, the kip tanning industry in India should endeavour to reach the pre-war average level of production so as to be able to export 5,000 bales monthly.

69. As regards skins, before the war, India (chiefly Madras) was tanning by the E. I. tanning process, 190.8 lakh skins of which 172.8 lakh were exported and 18 lakh retained in the country. The total of skins available in India before the war, including import, was 500 lakh; her own production was 445.7 lakh and the balance was imported. So, she has still 309 lakh skins to draw upon for E. I. tanning. Of these 13.2 lakh pieces of sheep skins were exported as raw in the year 1938-39. These should be retained for E. I. tanning by prohibiting export of raw sheep skins totally. In the same year 239.4 lakh goat skins were exported as raw. Of the raw goat skins usually exported, 30 to 40 per cent. according to Mr. K. H. Chamber's evidence before the Panel, are not suitable for glazed kid production. 30 per cent. of 239.4 is 72 lakh goat skins which can be retained in India for E. I. tanning without interfering with glazed kid stock. So, the Madras skin tanners may have $72+13.2=85.2$ or say 85 lakh skins for tanning in post-war years. This will mean an increase of about 40 per cent. over pre-war production and the Panel proposes that this should be kept, in view as the target for skin tanners during the first five years. It is in India's interest that they should be tanned in India and then exported. The foreign buyers would also gain by purchasing the tanned skins because they could then see the grain defects in tanned skins much better than in raw skins and they would thus be able to know what they were buying.

70. **Retanning and Finishing of E.I. tanned leather in India.**—It has already been stated that in the U. K. and other countries, Indian E. I. tanned leather is retanned and converted into different types of leather. Some of the E. I. tanned kips after retanning are also curried. It would be of great economic advantage to India if all this work were done in India and India exported the finished leather rather than the crust tanned stock. This is an entirely new line, awaiting development in this country, and a start should be made at once for its development. The existing chrome tanners in India should take it up as a side line. Much of the technique is already known to the various experts engaged in these tanneries and the production of saleable leather such as semi-chrome kips, russet kips, lining kips, morocco and shoe lining from E. I. tanned goat skins, roller skins for textile mills, finished shoe lining and various types of fancy leather from E. I. tanned sheep skins, will not be a difficult matter. In the course of the Panel's tour in Madras, it was found that a commercial firm had already started producing several types of leather from E. I. tanned stock at the Leather Trades Institute, Madras. The machinery and a portion of the tannery had been let out to it by the Madras Government. In Calcutta, a few firms produce dyed and finished leather from Madras tanned buffalo and cow hides, calf and goat and sheep skins and find a market for them. Heavier types of Madras tanned buffalo hides were retanned in strong bark liquor and finished as light sole leather and had a good market in Calcutta. Large quantities of E. I. tanned kips were also tanned and curried to produce russet kips for making military boots and shoes and other army equipments. It will be seen that a start has already been made in the line which should not be given up but should be vigorously pursued in order that gradually an increasing proportion of E. I. tanned leather may be finished in India. Attempt should be made to market these

finished leather in these countries which are now buying E. I. tanned leather. Help of the Indian Trade Commissioners posted abroad should be taken in this connection. Most of the witnesses in Madras, Messrs. Chrome Leather Co., Mr. K. H. Chambers and Mr. Seshachalam Choudhury expressed the opinion that the line had a good scope for development. Mr. Hepburn of Cawnpore thought that the dressing of E. I. tanned kips should be taken up as a long term policy. While Messrs. Cooper, Allen & Co., was doubtful about the success of an export trade in dressed E. I. tanned kips, the Company had been making Morocco and lining leathers from tanned skins since sometime and would be prepared to expand the line if the demand increased. Mr. Randall thinks that India is not likely to have a better opportunity than now of changing over from an export trade of raw and semi-finished leather to that of finished leather and leather goods.

70. (a) **Chrome retan kips.**—It is possible to give an entirely new orientation to the E. I. tanned kip industry by introducing chrome retan process which has now been well developed in Europe and America and turns out fuller and altogether better leather than that obtained by retanning and dressing the present E. I. tanned kips by semi-chrome or vegetable tannages. This process appears to be specially suitable for Indian kips, a great bulk of which are of poor substance; this inherent deficiency can be appreciably made up by the fulness imparted to the leather by the new developed technique of the chrome retan process. According to it, the kips will have to be first chrome tanned and subsequently vegetable tanned. The crust leather so obtained may be exported in place of the present E. I. tanned kips to be dressed by overseas curriers or dressed in India either for export or internal consumption. The process can be carried out alike by the Indian E. I. tanned kip as well as organised tanneries and it will relieve the strain on wattle bark, to an appreciable extent. It is expected that overseas curriers will prefer retan kips once their superior qualities are demonstrated. Development of the chrome retan process should be pursued in right earnest.

71. **Provincial Distribution of Production.**—There is scope for the manufacture of E. I. tanned leather in Bengal, Assam, Orissa and C. P. where suitable hides and skins are available. Rajputana produces large quantities of goat and sheep skins and it has also *avaram* bark. There is thus a prospect for developing the manufacture of E. I. tanned goat and sheep skins for export as well as for finished light leather for internal trades. Tanneries for the production of this leather should be started in suitable regions in the Rajputana states, e.g., Jaipur. In Rajputana as well as in some parts of the Punjab and Baluchistan, camel hides are available. From Baluchistan camel hides are exported as raw. Attempt should be made to tan camel hides and produce suitable leathers from them. Mr. Raney reported to the Panel that very soft leather for upholstering and artistic leather goods were to a certain extent made from these hides and further development would be beneficial. In Bombay, Sind and Kathiawar also E. I. kip and skin tanning can be substantially increased. In Kathiawar specially the production of E. I. tanned goat and sheep skins can be considerably expanded because suitable skins as well as *avarm* bark are available, and being near the ports of the West coast, there is facility for exporting them. Of the increase of 40 per cent. over pre-war production of E. I. tanned goat and sheep skins, a substantial share should go to Kathiawar. Similarly, in the Punjab, goat and sheep skins are plentiful, and the goat skins of that place being of coarse grained type are not suitable for glazed kid manufacture. Large quantities of the Punjab goat and sheep skins are at present sent to Madras for E. I. tanning, which should be done in the Punjab itself. Similarly, Bengal sends large quantities of kips and rejection goat skins to Madras for tanning which might as well be done in Bengal. Most of the Bengal hides sent to Madras are from the Eastern and Northern Bengal from places like Dacca, Narayanganj

Chittagong, etc. These are suitable places for producing E. I. tanned kips, because plentiful supply of good soft water is available. Wattle bark can be imported and labour can be suitably trained in these new areas. Much of the manual work that is at present done in South India in the E. I. kip tanning industry can be replaced by labour saving machinery and the new concerns taking up this line will be well advised to introduce machine work.

71. (a). In recommending the expansion of the E. I. kip tanning industry in other parts of India besides the Madras Presidency, the Panel does not contemplate that this expansion should necessarily be at the cost of Madras. Even before the war, India was exporting considerable quantities of raw hides and skins which could be usefully converted into E. I. tanned leather and exported as such if markets were available. Just before the war, the export of E. I. tanned kips from Madras was steadily increasing and if the war had not intervened, this increase might have been continuous. In post-war period, this is likely to have given the new entrants into the line, possibilities for disposing of their products. Further as indicated in para. 70, as the consumption of finished vegetable tanned or semi-chromed kip and skin leathers develops in India, these new entrants would be in a position, if they so like, to convert crust tanned hides and skins into finished leather themselves in their tanneries and meet the created internal demand. Again, it is envisaged that it will be possible to create an overseas demand for the finished vegetable or semi-chromed kip and skin leather in overseas markets and the new entrants would be able to export these leathers to foreign countries also. Those tanneries which will like to be content with the production of E. I. tanned or crust leathers only, will be in a position to sell crust stocks to other tanneries which will convert them into finished leathers, just as the producers of crust leathers in Europe and America usually do.

Summary of Recommendations

72. (i) The targets proposed above, *viz.*,-attainment of the pre-war level of production for the E. I. kip tanning industry (so as to be able to export 5,000 bales monthly) and tanning of 85 lakh skins should be aimed at during the first 5 years.

(ii) To provide sufficient hides and skins to the E. I. tanning industry, export of raw kips, buffalo hides, and sheep skins should be stopped and that of goat skins restricted according to the schedule given in para. 38.

(iii) To preserve the age-old and well-established E. I. tanned skins industry and to enable it to attain the proposed target, it is essential to abolish all restrictions on their export.

(iv) The existing ceiling prices of E. I. tanned skins in U. S. A. should either be abolished or enhanced by 150 per cent.

(v) Attempt should be made to bring wattle bark from Kenya and Australia.

(vi) Plantation of wattle in South India should be vigorously pursued.

(vii) Attempt should be made gradually to revive the use of *avaram* and *konam* in the Madras kip tanning industry and to increase the collection and supply of these barks by plantation if necessary. This is essential in view of the likelihood of the stoppage of South African wattle.

(viii) In view of the threatening shortage of manual workers in the South Indian Export Tanning Industry, hand work should be gradually replaced by machine and facilities should be given to manufacturers of E. I. tanned leather for importation of machinery.

(ix) Production of E. I. tanned leather should be increased in Bombay, Kathiawar and Orissa and started in Bengal, C. P., Rajputana and the Punjab.

(x) Retanning and finishing of E. I. tanned kips and skins should be developed in India with a view to export finished leathers.

(xi) Development of the chrome retan process should be pursued in right earnest.

(iii) **Pit tanned heavy leathers.**

(a) **Pit tanned sole leather.**

73. This is, far and away, a better sole leather than the bag tanned type and well finished and pressed according to up-to-date Western processes of vegetable tannage. The manufacture of pit tanned sole leather is at present concentrated at Cawnpore which is responsible for the bulk of its total production in India. There are eight big commercial tanneries which produce this leather at Cawnpore. A certain quantity is also produced in Calcutta by five tanneries, including notably the Bata's. Just before the recent war, the total annual production of pit tanned sole leather was about six lakh hides and the value of the production was about Rs. 72 lakh at the pre-war price of -/8/- per pound and taking a hide to yield 24 lbs. on an average. Pit tanning requires a large outlay of capital and is fundamentally, a capitalistic factory industry and not a cottage one.

74. **Effect of the War.**—The Supply Department specified the use of pit tanned sole leather for army boots and for other military stores. This stimulated pit tanned sole leather production to a very large extent. Fortythree organised tanneries which had the necessary equipment for producing pit tanned crust sole leather were brought under Government control and their entire output was purchased by the Government. A list of these tanneries showing their capacities for vegetable tanning (and also for chrome tanning by such of them as manufacture chrome leather as well), is given in Appendix IV. Their aggregate production capacity is 21 lakh buffalo hides annually which is 3 or 4 times the pre-war capacity. This capacity enables them to tan over 35 per cent. of the total buffalo hides produced in India. But they had to work only 30 to 40 per cent. of their capacity due to inadequacy of the supply of buffalo hides. The quantities of bark tanned leather supplied to the Government by the controlled tanneries are shown in Appendix IV. The bag tanners competed with them in the hide market and purchased considerable quantities, paying higher prices than what controlled tanneries could afford to pay due to fixation of prices (prices were revised quarterly) at which they had to supply to the Government. The pit tanning industry again learnt the technique of pit tanning process from the staff of the Controller of Leather and Tanning Industries who introduced the aproved process in these tanneries and helped the tanners in maintaining it by periodical inspections. A higher technique was thus spread out through the industry.

75. **Post-war expansion.**—The productive capacity of the industry has increased about 3½ times. If the controlled tanneries succeed in working to their full capacity or near it, it will mean a substantial expansion of the industry over its pre-war level. This should be regarded as the target for the first five-year period. The most essential thing to permit working to full capacity, is to ensure supply of adequate quantity of buffalo hides. According to the evidence given to the Panel by experienced pit tanned sole leather tanners. as well as by the Controller of Leather and Tanning Industry, for sometime to come, the demand for pit tanned sole leather in the home as well as in the export markets where Indian sole leather is consumed, will be quite up to production. Facilities for export will, however, have to be provided.

76. **Provincial distribution of sole leather production.**—The pit tanned sole leather tanneries which have already been started before and during the war are fairly distributed over the provinces best suited to its production. Among the provinces where pit tanned sole leather tanneries have not yet been started

and where there may be scope for the line, appear to be C. P., Kathiawar, Hyderabad (Sind), N.-W. F. P., Assam and Bihar in each of which a pit tanned sole leather tannery may be established. As Assam buffalo hides are fairly heavy and of good grain, the prospects for development of sole leather tanning in Assam appear to be promising. The Panel therefore recommends that one sole leather tannery should be started in Assam immediately and one more after five and ten years respectively. Initially, these tanneries should not aim to tan more than 20 hides daily or 500 hides monthly, because they will have to meet stiff competition of bag tanned sole leather. But gradually it will be possible for these tanneries to increase their output as it is envisaged that the expanding production of machine-made western type shoes in the manufacture of which pit tanned sole leather is usually preferred, will create an increasing demand for this type of leather. As the Punjab produces a large number of heavy buffalo hides and also has a fair supply of *babul* bark, it is one of the most suitable provinces for pit tanned sole leather production. The province should take up the line seriously.

Summary of Recommendations

77. (i) The export of buffalo hides should be totally stopped.
(ii) Export facilities for Indian sole leather should be provided.
(iii) Facilities for importing machinery by those tanneries which have not got full complement should be given.

(b) **Pit tanned harness leather:**

78. This is a variety of thick and heavy leather made from better grades of buffalo and heavy cow hides by the pit process of vegetable tanning which is very similar to that used for pit tanned sole leather discribed under (a). The bulk of its production is located at Cawnpore. The output of the Government Harness and Saddlery Factory at that place consists principally of this leather. In normal time, the output of the Harness and Saddlery Factory's harness leather appears to be sufficient to meet the military requirement and private tanneries make a small quantity only to cater for the civilian trade, the requirement of which is usually small. Due to the war-time demand, the production of crust harness leather appreciably increased in the Cawnpore commercial tanneries and it also spread out to the controlled tanneries in Calcutta, Agra, Madras, Trichinopoly, Bangalore and Bombay. Most of the controlled commercial tanneries supplied crust harness because they were not properly equipped and staffed to do currying themselves. The demand for curried harness leather by the civilian trade is not likely to increase very much during the first 5-year period.

79. In the questionnaire issued by the Panel there were the following two questions (18 and 19).

Question 18—Considering that during the war about 30 controlled tanneries supplied harness leather of approved quality in the crust form to the Government Harness and Saddlery Factory, do you think, they would be in a position to meet its requirement of crust harness leather also in normal time? Do you think that this supply to Government would be of assistance to the tanneries in their effort to work up to their extended output capacity in post-war years?

Question 19—Do you curry and market harness leather in the finished condition? How does your curried and finished harness leather compare with that produced in the Government Harness and Saddlery Factory? If the Government wanted, would you be able to supply finished harness leather of the approved standard?

80. The evidences of Messrs. Cooper, Allen and Co., Messrs. Eastern Tanneries Limited, Mr. Inskip personally and Major McBean show that the trade is confident that even if the post-war standard of harness leather is

raised, the trade will be able to satisfy it. The Government Harness and Saddlery Factory was established about 80 years ago when the Indian tanning industry for the production of harness leather was not developed. Since then, the industry has made considerable progress in practically all branches of leather manufacture including that of harness leather. Due to the progressive mechanisation of the army, the demand for harness leather is also not so acute as it used to be before mechanisation. Under the circumstances, the Panel is of the opinion that manufacture of harness leather in the Government Harness and Saddlery Factory would not be essential and whatever demand for it would remain during post-war years would be adequately met by commercial tanneries.

Summary of Recommendations.

81. (i) The tanning section of the Government Harness and Saddlery Factory should be closed down and the factory should purchase harness leather from the trade to meet army requirements. It is anticipated that the present technical staff of the Harness and Saddlery Factory can be absorbed by the commercial tanneries.

(ii) It should buy curried and finished harness leather from such tanneries in the trade as will be able to supply the leather of the approved standard.

(iii) The Currying Department of the H. & S. Factory should be continued for 3 years to finish the trade's crust harness after which period, it is expected that commercial tanneries will be able to curry the leather. After 3 years the Currying Department should also be closed down.

(c) **Belting Leather:**

82. This is a thick heavy curried leather having considerable tensile strength. In Europe and America, this leather is produced from selected ox hides by the pit method of vegetable tanning. In India, belting butts are produced from the best available buffalo hides by the pit tanning process similar to that used in sole and harness leather tanning. But buffalo hides having a looser texture than European and American ox hides, the Indian leather belting is considered by users to be inferior to imported leather beltings made from ox hide butts. The Government Harness and Saddlery Factory at Cawnpore makes a certain amount of belting leather. Messrs. Cooper, Allen & Co., also manufacture some quantity of it. The manufacture of belting leather is still only a small side line of some of the bigger pit tanned leather tanneries. Until and unless buffalo leather belting becomes popular in India, no development in this line of leather can be envisaged. How the buffalo leather belting can be popularised is discussed in Chapter VIII.

II. CHROME TANNING.

(vii) **Box and Willow sides, kips and calf**

83. These are soft leathers of medium and light substance produced by chrome tanning and highly glazed by finishing with suitable machinery. The leather are used for making shoe uppers. Practically 100 per cent. of the western types of shoes made in India are prepared from them. The manufacture of box and willow sides and kips is at present localised in Calcutta, Cawnpore, and Madras principally and to a certain extent also at Agra, Bangalore, Trichinopoly, Bombay and Sholapur. The Bata Shoe Co., four Indian tanneries and about 200 Chinese tanneries in Calcutta; Messrs. Cooper Allen & Co., and three Indian tanneries in Cawnpore; Chrome Leather Co., and Messrs. Gordon Woodroffe Leather Manufacturing Co. Ltd. at Madras and one tannery each at Trichinopoly, Bangalore, Bombay and Sholapur are engaged in this line of manufacture. Chrome tanning has not yet spread out to other centres besides those mentioned.

84. In the report on the Survey of Leather Industries in Bengal. Government of Bengal, Department of Industries, Bulletin No. 86, published in

1941, an estimate of the total annual production of chrome leather in Calcutta, Cawnpore and Madras is given as below:—

TABLE XII

	Sq. ft.
Calcutta	15,721,900
Cawnpore	13,680,000
Madras	11,244,000

85. Out of these, 11,404,800 sq. ft. valued at Rs. 21,38,400 was Chinese leather known in the trade as China chrome, leaving the balance of about 29¼ million sq. ft. as the product of the European and Indian tanneries. The total value of pre-war annual production of chrome upper leather was about Rs. 1-1/3 crores.

86. During the quinquennium ending 1938, 7-1/3 million sq. ft. of chrome leather on an average used to be exported annually. During the war, much of this export was stopped due to the war time restrictions on movement of hide and leather and also to the pre-occupation of most of the chrome tanneries in manufacturing bark tanned sole leather for defence services; consequently they could not maintain their pre-war output of chrome leather. The Chinese tanners in Calcutta, however, succeeded in increasing their chrome leather production from the pre-war average figure of about 11½ million sq. ft. to about 33 million sq. ft. annually. The average production of chrome leather of Messrs. Cooper, Allen & Co., during the 5 years, 1940 to 1944 was 13,599,248 sq. ft. whereas their average production during the two years 1937 and 1938 was 7,489,980 sq. ft. It may, therefore, be definitely stated that the production of chrome leather substantially increased during the war.

87. **Post-war development and targets**:—It is estimated that the existing chrome tanneries in India have the capacity to turn out 70 million sq. ft. of chrome box and willow sides, kips and calves annually. There was an export market for about 7 million sq. ft. annually before the war. Considering the acute shortage of this type of leather and persistent enquiries for it from overseas, it appears that export demand will substantially increase during the first 5-year period.

88. It is planned that during the first five years, production of western types of shoes in India would be increased from the present figure of 30 million pairs to 45 million pairs and when this footwear target is reached it will consume about 70 million square feet of chrome leather which is what the entire chrome leather industry in India can produce according to its present capacity. The capacity of chrome tanneries should therefore be increased to meet both the growing internal and external demands. The target for the first five years should be 10 per cent. increase annually over the present production of 70 million sq. ft. This will give a total production at the end of five years of 105 million sq. ft. of which 93 million sq. ft. will be required for internal consumption to reach the footwear and leather goods targets and the remainder of about 12 million sq. ft. will have to be exported, principally to U. K. This will mean chrome tanning about 58 lakh cow hides, including kip and calf skins annually. To make this expansion possible, adequate quantities of hides should be made available to the chrome tanneries by prohibiting export of raw cow hides, by abolishing all restrictions on the internal movement of hides from the producing to the chrome tanning centres, restoring movement of hides and chrome leather to the pre-war freedom, and by affording facilities to the existing chrome tanneries to import new machinery to replace their worn out plant. New chrome tanneries for the manufacture of box sides, kips and calf, should also be started in suitable provinces like the Punjab, C. P., Bihar, Bombay, Bengal, Assam and Madras and all facilities should be given them for importation of machinery. In Assam one chrome tannery for making box sides may be started immediately and one more after five and ten years respectively. In these tanneries the better selections of cow

hides should be chromed and inferior ones vegetable tanned for the production of E. I. tanned kips.

Summary of Recommendations

89. (i) The target for the first 5 years should be 10 per cent. minimum increase annually over the present production.

(ii) Existing chrome tanneries should be given facility and high priority for the importation of machinery.

(iii) New chrome tanneries may be started at centres mentioned in para. 88 and facilities for the importation of machinery should be given them. The new entrants should be advised to start on a moderate scale to gain experience and expand gradually.

(iv) Export of cow hides should be totally prohibited.

(v) The quality of the Indian chrome leather should be further improved by the installation of up-to-date machinery in the existing chrome tanneries. The machines of many tanneries are very old and worn out and out of date. Their replacement is essential in the interest of efficiency of production and leather quality.

(vi) Research should be carried out in the tanneries and in the proposed Central Leather Research Institute to improve the quality of this leather so that it may be more and more appreciated in foreign markets, conducing to its larger sale abroad.

(vii) To stop the over-measurement of chrome leather, a Leather Measurement Act for the whole of India should be promulgated by the Central Government.

(viii) All restrictions against the export of this leather should be abolished and export to all overseas markets permitted. There is no shortage of this leather in India.

(viii) **Glazed Kid**

90. This is a fine, light and soft leather prepared from goat skin by chrome tanning. It is used in making ladies' shoes as well as lighter types of gents' footwear. Its manufacture is now principally located in Madras where two European tanneries, Messrs. Chrome Leather Co., and Messrs. Gordon Woodroffe Leather Manufacturing Co., Ltd., produce it. Recently Messrs. Cooper, Allen & Co., have also started on the line at Cawnpore. In Calcutta the National Tannery Company Ltd. and the Calcutta Tanneries Ltd. are reported to be experimenting with the production of glazed kid and the experiments are not altogether unsuccessful. One or two Chinese tanneries also produce glazed kid. The Mysore Tannery at Bangalore is also carrying out experiments on glazed kid manufacture. The Western India Tanneries Ltd., at Bombay are producing small quantities of the leather.

91. The export figures for glazed kid from India for 3 years before the war are given below:—

TABLE XIII

Year	Quantity in sq. ft.	Value in Rs.
1936	200,000	1,10,700
1937	1,558,000	9,72,000
1938	1,700,000	9,32,310

92. Both Mr. Phillips and Mr. Newman representing Messrs. Gordon Woodroffe Leather Manufacturing Co. Ltd. and Chrome Leather Co. Ltd. respectively reported that they had been selling glazed kid both in India and abroad. Their standard of quality was appreciated in the foreign markets from which they concluded that the quality of their leather was nearly equal to the western standards. It appears that the pioneering stage has been passed. The glazed kid industry has established itself to a certain extent and is now fit to press its claim for further expansion.

93. **Prospects of expansion.**—Looking at the industry from the view point of the availability of suitable raw materials, there appears to be a very big scope for expansion. As shown in Table VI, para. 33 in 1938-39, 239.4 lakhs of raw goat skins were exported from India. Mr. Chambers in his evidence in Madras informed the Panel that about 30 per cent. to 40 per cent. of the exported skins were unsuitable for glazed kid. Taking even the higher figure, 143.6 lakhs or, in round figure, 150 lakhs of the skins normally exported would be suitable for glazed kid production. It may, therefore, be taken that India can annually turn out about 150 lakhs of pieces of glazed kid over and above what she produces now if she retains these 150 lakhs in the country for the purpose. So, for the expansion of glazed kid manufacture, 150 lakh pieces may be taken as the long term target. With a view to step up production, the following targets are proposed.

94. **Post-war targets:—**

First 5 years	30 lakhs
Second 5 years	60 ,,
Third 5 years	100 ,,

95. **Cost of Glazed kid tannery.**—Mr. Chambers in his evidence informed the Panel that the cost of a glazed kid tannery having an output of 150 dozen skins daily would be as follows:—

Fixed Capital	Rs. 7½ lakhs
Working Capital	Rs. 5 ,,

This tannery will be able to finish tanned goat and sheep skins to the extent of about 150 doz. daily to take fancy leather. If it is equipped for this purpose, the following amount of capital will be needed:

Fixed Capital	Rs. 8½ lakhs
Working Capital	Rs. 6½ ,,

These estimates are, of course, subject to fluctuation of prices of machinery and material.

96. **Provincial distribution of glazed kid production.**—As two big tanneries are already producing it in Madras, it is not necessary to start any new glazed kid tannery there. As Messrs. Cooper, Allen & Co., have started the line in U. P. and other tanneries in that province will most probably add glazed kid departments to their tanneries, no separate glazed kid tanneries will be needed there at this stage.

97. The most suitable provinces for new glazed kid tanneries appear to be Bengal and Bihar where the line is still undeveloped and suitable goat skins are available. There is scope for a number of glazed kid tanneries in each of these two provinces. In Bombay and U. P. there is already an expanding market for glazed kid and as such there are prospects for glazed kid tanneries in these two provinces also. As in other provinces suitable skins and market are lacking, there appears to be no scope at this stage for glazed kid tanneries in them.

98. **Technique of glazed kid manufacture.**—Messrs. Cooper, Allen & Co., in their evidence state that in their opinion glazed kid is a more highly specialised

product than chrome leather (box and willow sides, box calf, etc.) and its production should be divorced from that of ordinary chrome leather. Educated and intelligent workmen with practical training are needed to develop this industry. The development should be fostered by the Government which can assist by granting facilities for the import of the necessary plant and obtaining the services of skilled technicians. As the industry develops, the export of raw skins, particularly from these districts where the best types are available, should be restricted.

99. Messrs. Chrome Leather Co. Ltd. in their oral evidence state that technical research on glazed kid production in an experimental glazed kid tannery can considerably aid in improving the quality of the Indian glazed kid still further. They also state that in respect of technical skill, American and British glazed kid tanning experts are equal and an expert could be looked for in either of these two countries.

100. Mr. S. K. Sen of the National Tannery Co. Ltd., Calcutta in his written notes stated that for glazed kid specially, research and experiment are needed and Government assistance may help considerably. Artificial bates are essential in glazed kid manufacture, and research should be carried out in India to make bates in this country from animal pancreas, especially pig pancreas, similar to pancreol 5A. In their written evidence, the National Tannery Company Ltd., state that large scale experiments are necessary for the development of the glazed kid industry specially for silver and gold kids and for finishing glazed kid.

101. Mr. Chambers stated that glazed kid experts might be obtained from U. K. and U. S. A. and possibly from German Jews. Theoretically, it seems better to have a factory making only one article, but in the leather trade with changing demand, there are certain advantages in a tannery which turns out more than one kind of leather. The production of glazed kid can with advantage be combined with the finishing of tanned goat and sheep skins, since practically the same machinery can be used for both. The technical difficulty of manufacturing glazed kid can be overcome. He is against State-managed glazed kid tanneries since there are already a number of them managed by private companies, in existence There is considerable room for large scale production in India.

102. **Marketing of glazed kid.**—Although the popularity of glazed kid shoes is increasing in India, the demand for glazed kid is yet very small in the Indian home market because of its expensive nature. If glazed kid manufacture is expanded according to the targets indicated in para. 94, the product will have to be marketed abroad. An organised marketing programme will be essential. In this connection, the remark of Mr. Chambers is worthy of note. He says in his evidence, that if India endeavours to flood the world market with glazed kid, she will come up against considerable opposition from the established industries in foreign countries. It is unlikely for instance that U. S. A. Government would allow very large import of glazed kid into the United States to the detriment of their own large and well established glazed kid industry. He also considers, however, that there should be good export trade for glazed kid in black and in one or two staple colours; changes of fashions militate against export trade in anything approaching fancy colours. Tariffs in foreign countries will have to be overcome.

Summary of Recommendations

103. (i) The targets proposed in para. 94 should be aimed at.

(ii) To facilitate the expansion of glazed kid manufacture in India and to preserve the other lines of the Indian tanning industry in which goat skins are used as raw material, the export of raw goat skins should be restricted in accordance with the schedule given in par, 38.

(iii) Facilities should be given to the intending producers of glazed kid for getting machinery and technical personnel from abroad.

(iv) Students and technicians already working in tanneries and with experience of manufacture should be sent abroad for acquiring the knowledge of the technique of glazed kid manufacture, in U. K. and U. S. A. and Continental Europe with Government scholarship and facilities for their work and study should be arranged in these countries by the Government.

(v) Research should be undertaken on the technique of glazed kid manufacture and the making of essential materials needed in the manufacture, at the proposed Central Leather Research Institute.

(vi) A glazed kid expert should be brought out by the Government either from U. S. A. or U. K. whose services should be made available to glazed kid manufacturers throughout India for technical guidance.

(vii) Trade Commissioners should be requested to help in the marketing of Indian glazed kid in the countries where they are posted.

(viii) Encouragement and help should be given by Government to establish one glazed kid tannery each in Bengal, Bihar, and other suitable provinces as mentioned in para. 97.

MINOR TYPES

104. All other types of leather given in the list in para. 52 fall under this head. For none of these is there any large or steady demand either in the home or export market. No large tannery can work exclusively on any of these lines. At present, they are being produced in different parts of India either by small concerns or in sections of big tanneries which are producing the major items of leather as their main lines. Some of the more important ones among them are discussed below.

Minor Vegetable Tanned Leather.

(iv) **Pit tanned dressing leather.**

105. This is made from cow hides and used mainly for making travel goods like suit cases etc. A number of small tanneries are producing this leather in Calcutta. Some of the bigger tanneries produce it as a side line. There is a considerable scope for its further development.

(vi) **Pit tanned light leather.**

106. Certain quantities of sheep and goat skins are vegetable tanned for shoe lining leather and they are also dyed and finished for use in making uppers for shoes of lighter types and also for making purses, portfolios and other leather goods. The demand for this leather is increasing and it is expected that there is a good scope for its large scale development. But a suitable tanning material for light skin tannage like Sicilian sumach, is needed for this. Mr. Hepburn, the Controller of Leather and Tanning Industries states that Dhawa leaves may be used in place of sumach. Syntans may help, either used singly or in admixture with some of the local tanstuffs. Experiments are needed in this connection.

Summary of Recommendations.

107. (i) Investigation should be undertaken at the proposed Central Leather Research Institute on light leather manufacture with (a) Dhawa leaves, (b) mixture of Dhawa leaves and syntans and (c) with other local tanning materials singly and mixed with syntans.

(ii) Research should be undertaken at the Central Research Institute on the production of Syntans in India.

(iii) Plantation of Sicilian sumach should be tried.

Minor Chrome Tanned Leather.

(ix) Chrome suede and imitation sambar.

108. Chrome suede is a light leather made by chrome tanning sheep and goat skins and buffing them on the flesh side to produce a velvety nap and dyeing them into black and various shades of colour. Its use and demand are increasing and the line is full of prospects. Imitation sambar leather is made from chrome or semi-chrome tanned cow hides dyed and finished on the flesh side with a velvety nap like suede. It is a very good side line for chrome tanneries, producing box sides and kips and will most probably be carried out as such in post-war years.

109. It is difficult to give an accurate estimate of production of suede leather in post-war years but considering its increasing popularity, it will be possible to double the production in the first 5 years and this should be taken as the target for this line. As regards its marketing, the home market will consume the bulk of the production but an export market is also possible if the standard of its quality is maintained at a high level. As this leather requires only a small equipment of machinery, the only absolutely essential machine being a buffing wheel, it is a line which can be pursued even by people with small means. Its manufacture can be carried out almost everywhere in India on a small or medium scale. The production of suede leather should be widely distributed regionally. The same remark applies to imitation sambar.

Summary of Recommendations.

110 (i) The existing glazed kid tanneries should take up the production of suede leather as a side line.

(ii) The existing box and willow side manufacturers should take up the production of imitation sambar as a side line.

(iii) The small tanneries in Calcutta and elsewhere which are producing suede and imitation sambar exclusively should be given facilities to import machinery they may need to increase their output and to improve the quality of their product.

(iv) Encouragement should be given to make suede and imitation sambar leather in all the provinces.

(v) The Indian Trade Commissioners in foreign countries should be requested to help the development of a market for Indian suede and imitation samber leather in the countries in which they are posted.

(xi) Neobuck leather.

111. This is a white leather made from light kips and kip sides by giving them a light chrome tannage and depositing on it white pigments to make them appear white. There is some demand for this leather in India. The Chinese tanneries in Calcutta and a few other Calcutta tanneries as well as the Chrome Leather Company, Madras are producing this leather. The quality is not yet entirely satisfactory and upto the standard of the imported neobuck. Research on the production of this useful leather is called for. New methods of producing white leather have been recently reported from America and elsewhere. One of these employs a basic Zirconium salt. Zirconium tannage deserves trial in India.

Summary of Recommendations.

112. (i) Research should be carried out on the production of satisfactory neobuck and other types of white leather.

(ii) Output of this leather should be increased by at least 100 per cent. above present production during the first five-year period.

(xii) **Chrome Patent Leather.**

113. This is made from chrome tanned kip sides. The Chrome Leather Co. Ltd., Madras has carried out a lot of experiments on its production and has been turning it out on a large scale since the last 6 or 7 years. In his oral evidence. Mr. Newman of the Chrome Leather Co., states that the demand for his company's chrome patent leather was so heavy in the Indian market that there was no occasion for the firm to export it. He thought that the drier Northern Indian climates of U.P., and the Punjab would be more suitable for chrome patent leather than the humid climates of Bengal and Madras. This is, however, contrary to the opinion generally held in the Indian tanning industry. It is generally regarded that on account of the existence of a great deal of dust in the atmosphere, in the Punjab and U.P., these areas are not suitable for patent leather manufacture. In their evidence to the Panel, Messrs. Cooper, Allen & Co., state that they carried out experiments on chrome patent leather before the war. But the production was not entirely upto the Western standard. Furthermore, the dry dusty climate of the U.P., according to their opinions, is not suitable for the manufacture of good patent leather. Mr. Chambers in his evidence says that chrome patent leather is, far and away, the most difficult leather to make satisfactorily. High technical efficiency is needed, highly skilled workmanship is essential and a large capital outlay is necessary. His experience is that the Indian market would take fairly large quantities of patent leather even if it be slightly inferior to imported leather. He doubts very much whether India could compete in foreign markets with its patent leather.

114. As there is a considerable demand for chrome patent leather, the Panel thinks that there is a large scope for its development. The drier climate of U.P. and the Punjab may be of advantage in eliminating the defect of tackiness but it would not be possible to manufacture the leather properly unless the operations are carried out in glass houses in order to protect the leather from atmospheric dust while it is in the process of drying. The development will proceed more easily in Calcutta where a good start has already been made.

Summary of Recommendations.

115. (i) The output of chrome patent leather by producers should be increased at least by 100 per cent. during the first five years.

(ii) Research should be carried out to improve its quality and to work out the technique of production in conformity with the Indian climatic condition and seasonal variations.

(iii) When the Indian product attains a reasonable standard of quality, the foreign Trade Commissioners should be requested to develop a market for Indian patent leather in foreign countries.

Enamelled hide.

116. This is leather made from spready vegetable tanned cow hides by putting coatings of coloured nitro-cellulose lacquer on the grain surface or on the buffed surface of splits, to produce a flexible and water resisting film. The leather is used for upholstering motor car, seats of upper class railway compartments and furniture. The leather is not made in India on any large scale as yet; but there is a certain demand for it for upholstering work which is likely to increase when, as it is proposed, motor cars will be made in this country during the post-war period.

(xiii) **Picking Bands.**

117. These are leather straps, 1″ to ¾″ wide, ¼″ to 5/16″ thick, and 24″ in length which are fitted to textile looms. A large quantity of picking

bands is used in the cotton and jute textile industries of India. The volume of import during the quinquennium ending 1938-39 is given below.

TABLE XIV.

Import of Picking Bands
(In lakh of rupees)

1934-35	7.9
1935-36	8.6
1936-37	6·4
1937-38	11·2
1938-39	8·7

118. **Production in India.**—Ever since the outbreak of the last World War in 1914, attempt has been made to manufacture picking bands in India by chrome tanning heavy buffalo hides of the best available quality and stuffing the leather suitably. During Great War I, as during Great War II, picking bands made in India enjoyed a good sale. But at the end of both the wars when the importation of foreign bands was resumed, the consumption of locally made bands fell off. The only tannery, according to evidence given to the Panel, which enjoys an uninterrupted demand for its picking bands, is the Western India Tannery Ltd., Bombay. Mr. Pandit giving evidence to the Panel reported that he was making 5 to 6 thousand pounds normally and found no difficulty in selling them in competition with English bands.

119. Mr. K. M. Chambers of Madras states in his evidence that the difficulty with regard to manufacture of picking bands in India was the non-availability of the best types of raw material. Good quality picking bands could be made in this country but they were not as good as imported bands which were made from heavy ox hides of Europe. The Indian manufacturer is handicapped by poor material. A perfect butt free from flay cuts, brands, sores and of a thick substance is necessary and heavy buffaloes in India are almost always badly flayed. According to Mr. Chambers, picking bands cannot be successfully made in any independent unit. It can only be manufactured in a tannery which produces bark tanned sole leather also, so that buffalo hides which cannot be turned into picking bands can be made into sole leather.

120. It appears that the Indian tanning industry has been endeavouring to make picking bands and introduce them to the mills but has not yet succeeded in establishing the line on a suitable basis. When the bands were found to be good enough during the war, they ought to be usable also in normal times. If the local producers get a period of steady business, they will be able to improve the quality with experience. It appears that Indian picking bands should be protected by a duty imposed on imported bands.

Summary of Recommendations.

121. (i) Export of buffalo hides should be stopped lest suitable ones for making picking bands go out of the country.

(ii) Flaying of buffalo hides should be improved so as to provide faultless hides for making picking bands.

(iii) Research should be carried out to increase the tensile strength of locally made picking bands with proper chemical control of the process of manufacture as pointed out by Mr. Pandit and by Mr. Hepburn in their evidence to the Panel.

(iv) Heavy import duty should be imposed on imported picking bands to protect the local industry.

Roller skins.

122. These are made from vegetable tanned sheep skins of tough and strong grain and are used in spinning mills of the textile industry. Before the war

the demand from the Indian textile industry was largely met by import. Skins valued at from Rs. 6 to 8 lakh were imported annually. Attempts were made to manufacture suitable roller skins in India before the war and its manufacture was greatly stimulated during the last war. A few tanneries in Madras and Bombay make roller skins at present. Mr. Malvenan in his note says that this line has been developed effectively in India since the outbreak of the war and can reasonably be expected to last for some years at least and that the manufacture of roller skins in India may be encouraged. He further informs the Panel that in England, roller skins are not made entirely from Madras tanned sheep skins and Mr. Chambers states in his evidence that roller skins of size 26″ x 22″ imported into India and chiefly demanded by the mills are made from Welsh sheep. He further says that the hairy sheep skins of Madras are the best raw material in India for roller skins but unfortunately only a few of them yield leather of the required size 26″ x 22″.

Summary of Recommendations.

123. (i) Roller skins are a necessary industrial leather and their manufacture should be developed and placed on a firm basis.

(ii) To protect the Indian Roller skin industry a heavy duty should be imposed on imported roller skins.

123(a) The disposal of available hides and skins in India in 1938-39 and when the planned targets of the various leather and leather goods, are attained, are shown below in Table XIV (a).

TABLE XIV (a)

(In lakh pieces)

	Actual disposal in 1938-39	Planned disposal after 5 years	Planned disposal after 15 years
I. Total buffalo hides available			
Exported as raw	6·2	0.0	
E. I. tanned in Madras (estimated)	4·0	4.0	
Bag and otherwise crudely tanned (estimated).	45·5	36·5	
Pit tanned	6.0	21·0	
Chrome tanned	0·3	0.5	
Total	62	62	
II. Total cow hides available			
Exported as raw	46·1	0·0	
Half tanned mostly in Madras for export	82·0	82·0	
Bag and otherwise crudely tanned (estimated).	45·5	59.0	
Chrome tanned for box sides, kips and calf.	25·0	58.0	
Pit tanned	6·4	6·0	
Total	205	205	

	Actual disposal in 1938-39	Planned disposal after 5 years	Planned disposal after 15 years
III. Total goat skins available . . .			
Exported raw	239.4	137.4	37 4
Vegetable tanned mostly in Madras for export.	49.2	121.2	121·2
Chrome tanned into glazed kid & suedes assuming total production as double of export and 3 sq. ft. per skin.	11·4	41.4	141·4
Total .	300	300	300
IV. Total sheep skins available . . .			
Exported raw	13·2	0.0	
Vegetable tanned mostly in Madras for export and to a smaller extent chrome tanned.	186·8	200.0	
Total .	200	200	

CHAPTER VI.

Technical Training and Research.

124. At present there are the following Training Institutes in India:

(1) The Madras Leather Trades Institute under the Industries Department the Government of Madras. It is running two courses for artisans: (i) a one-year course in simple leather goods manufacture for the local boys, and (ii) a two-year course for muffasil boys in leather goods manufacture. Only chamar boys are admitted. Formerly this Institute had a higher three-year course in Leather Technology.

(2) The Bengal Tanning Institute in Calcutta. This is under the Department of Industries, the Government of Bengal. It runs three courses: (i) A senior course of 3 years in leather technology for the University certificate in Tanning for which purpose the institute is affiliated to the Calcutta University. Minimum qualification for admission to this course is I.Sc. pass in Physics, Chemistry and Mathematics. (ii) A junior course of two years to which matriculates are admitted. They are awarded a Departmental certificate in Tanning on passing the final examination. (iii) The third course of one year for boots and shoes and leather goods to which students who are fairly literate and have had a school education are admitted. A scheme has also been put to the Calcutta University for a B.Sc. Degree course and a still higher course namely M.Sc. and D. Sc. in leather technology.

(3) Bombay Tanning Institute. This is under the Industries Department, the Government of Bombay. It has two courses in tanning—a two-year advanced course and a one-year artisan course. It has also a Leather Working School attached to it which has similar two courses.

(4) Jullundur Tanning Institute. Three courses are followed, First, a three-year course for educated students to train them up as leather technologists. The second is an artisan course of one year for chamar boys. Under the third are special courses for advanced work.

Tanning Demonstration Parties.

125. A number of Tanning Demonstration Parties are attached to all these provincial institutes to give training on improved methods of tanning to muffasil students. Good work appears to have been done by the parties in the Punjab and Bombay in improving bag-tanned leather. In Bengal these parties have introduced in muffasil areas improved processes of vegetable and chrome tanning. Some of the trained students are running cottage tanneries.

126. Tanning Institutes were also started at Cawnpore and Nagpur after the first world war. These Institutes have, however, been closed down. At its meeting at Cawnpore, the Panel enquired of Mr. Hudlikar who had been in charge of the Cawnpore Tanning Institute about the reasons for its closing down. This Institute was attached to the Harcourt Butler Technological Institute at Cawnpore. Lack of sufficient number of applications for admission was adduced by Mr. Hudlikar in his evidence as the chief reason for the closing down of the Institute. Only B.Sc's were eligible for admission and as these science graduates after taking the training in leather technology could not get lucrative jobs in the industry, candidates for admission fell off. To the question if under-students could not be admitted, Mr. Hudlikar replied that in his opinion students under B.Sc. standard were unsuitable for training in leather technology.

127. There is now Training School at Fatehpur near Cawnpore, when an elementary course of training in tanning is followed. The Government Harness and Saddlery Factory at Cawnpore introduced a system of training apprentices for the trades in tanning and currying, and harness and saddlery making. It was stopped during the war.

128. Mr. Hepburn in his evidence said that the establishment of a Tanning Institute at Cawnpore would serve useful purposes. Messrs. Cooper, Allen & Co., in their evidence stated that they assisted materially in setting out the tanning section of the Harcourt Butler Technological Institute with machinery etc., but they did not know why the section was closed down. They further said in their evidence that in the event of a Tanning Institute being established at Cawnpore—provided it is run on sound lines—they would be prepared to admit selected students as apprentices in the tannery.

Importance of training in Leather Technology.

129. Modern leather manufacture is progressive. It is applying to an increasing extent the sciences of chemistry, physics, bacteriology and microscopy which are improving leather quality and providing tanners with new materials for use. Two types of technologists are required. Leather Chemists having sufficient knowledge of practical methods of leather manufacture who may be fit for the higher technical jobs in tanneries and Foremen tanners who may take charge of different departments of a tannery. Both these classes of men are to acquire adequate knowledge of the methods of manufacturing the principal varieties of commecial leather which are produced in India. To impart this knowledge, a Tanning Institute should have a small tannery equipped with a set of indispensible machinery and pits. The head of the Institute should be a Leather Chemist, preferably having experience of commercial leather manufacture, gained by actual participation in it in a commercial tannery for some time. He should have under him practical tanner capable of producing the different types of leather. Without these two key men, no Tanning Institute will be able to impart efficient tanning to the students.

130. The panel has visited most of the Tanning Institutes in India. Some of them have got the required equipment of machinery while some require additions and replacement. The Panel was informed that schemes for the

reorganisation and extension of the activities of the Tanning Institutes, had been submitted to the respective Provincial Governments and were under the latter's consideration. The courses followed at these Institutes are usually on the lines of those of the British Tanning Institute. The syllabuses are adequate but what all the Institutes lack is facility for giving the students a period of training in a commercial tannery. Everybody connected with the trade whose evidence the Panel took, emphasized the need of supplementing the Institute's training with a period of work in a commercial tannery.

131. Whether the number of the institutes should be increased requires careful consideration. Past experience has shown that the institutes at Cawnpore, Nagpur and Madras had to be closed down, mainly due to lack of students. Untill there is an appreciable increase in the number of students seeking training in leather technology, it may be better to have a few Tanning Institutes where facilities should be provided for training students from other provinces. The Provincial Governments maintaining the existing institutes may formulate some rules with regard to contributions from those provincial Governments which may send their students for training. Such arrangement exists at the Bengal Tanning Institute which reserves permanently seats for students from Bihar and also provides accommodation to students coming from other provinces and States, When the proposed Leather Research Institute as recommended in para 135, is established, facilities should be arranged for the admission of and training in research for students coming from different provinces and states. Some special reservations should be kept for nominees of provinces which are comparatively undeveloped and backward in regard to the leather goods industries in India. The Central Government should also send students for training abroad in leather technology, under its scheme for industrial and technological training in foreign countries. But for training workmen and artisans for the tanning, shoe and leather industries, provincial and State Governments should establish elementary leather trades institutes for giving facilities to the local *chamar* boys and those from other communities who may be inclined to take up leather work. In these elementary training institutes, facilities should be provided for training in machine work also by equiping them with such machines as splitting, shaving, staking, glazing, etc. in the case of the tanning course and upper sewing, lasting, bottom attaching and finishing machines in the boot and shoe making course. In order to facilitate practical training of artisans and higher personnel of leather industries, any special Government assistance to commercial tanneries should be conditional on the latter arranging for adequate facilities for the training of student apprentices.

Summary of Recommendations.

132. (i) The existing Tanning Institutes should be made more efficient and useful by addition being made to their equipment and by their having better paid staff.

(ii) The students of these institutes before they get their final certificates or diplomas, should be made to work in industrial concerns. Central and provincial Governments should arrange with industrial concerns provision of facilities for such training and apprenticeship and any special assistance given to them should be conditional on rendering all such facilities.

(iii) At the present stage, i.e., until the number of candidates seeking admission increases appreciably, the number of Tanning Institutes should not be multiplied, but interprovincial arrangements should be made for the training of students of all the provinces and States in the existing Tanning Institutes.

(iv) Students should be sent abroad by the Government with scholarship for training in leather technology.

(v) Elementary institutes for training in leather trades, should be established.

Research in Leather Technology.

133. In Europe and America a great deal of research is being conducted in Leather Technology either in separate Leather Research Institutes like the British Leather Manufacturers' Research Institute in London, the Leather Industries Department of the Leeds University in U.K. and at the Universities of Cincinnati, Lehigh, etc., in U.S.A. Tanning processes are greatly affected by climatic conditions and nature of raw materials available in a particular country. Both of these are different in India from those obtaining in Europe and America. The processes used, however, in the modern Indian tanning industry are mostly those of the West. Unless those processes are substantially modified to suit Indian conditions by adaptive research, results similar to those obtained in Europe and America from Western processes cannot be obtained in India. Although some of the witnesses examined by the Panel have stated that in box sides and glazed kid they are getting as good a result as are achieved anywhere else, the success is confined only to a few tanneries which have been able to engage European experts and have facilities for carrying out research all the time in their own tanneries. The bulk of the tanneries in India are not, however, so fortunate. They have to be helped by results of research carried out in a well-equipped Leather Research Institute. Besides, there is the question of keeping the Indian Leather Industry abreast of the leather industry in Europe and America all the time to maintain its competitive strength, as a considerable proportion of Indian leather of all varieties has to be marketed at home and abroad in competition with the production of Europe and America. All the witnesses examined by the Panel have stressed the necessity of research on Leather Technology being carried out in India and they have all supported the proposed establishment of an All-India Leather Research Institute at a suitable place. A scheme for a Central Leather Research Institute has been prepared and is given in Appendix V of the report. It involves the following expenditure—

Capital cost.....Rs. 20 lakhs.

Running cost.....Rs. 4 lakhs.

The cost involved is not greater than the costs of other All-India Research Institutes already sanctioned by the Government. As regards its relationship with the provinces and the states and its financial basis, the Institute will be on the same footing as other national research institutes which have already been or are being started under the auspices of the Central Government.

134. In this connection the Panel would like to draw the attention of the authorities to the following resolution passed by it at its 4th meeting held at Bombay on the 26th September, 1945:—

> "The Leather and Leather Goods Panel is emphatically of opinion that research is indispensible to the progress and efficiency of any industry. The Panel feels that there are very little facilities for carrying out research on problems connected with the leather industry in India and this has been detrimental to the progress of the industry. In view of the above facts, the Leather and Leather Goods Panel recommends to the Government that immediate steps be taken to establish an adequately equipped All-India Leather Research Institute at a suitable centre where the leather industry has developed and where there is a congenial atmosphere and facilities for scientific research. The Panel recommends for the consideretion of the Government a scheme for such an Institute, prepared by Rai Bahadur B. M. Das on the lines of similar Institutes in Europe and America."

The resolution was moved by Mr. Bool Chand and seconded by Mr. P. S. Pandit and carried unanimously.

Summary of recommendations.

135. (i) The Panel strongly recommends that a Central Leather Research Institute be established at a suitable place by the Central Government. A scheme for this is given in Appendix V for consideration of the Government.

(ii) As regards its relationship with the provinces and the States, the Institute will be on the same footing as other national research institutes which have already been or are being started under the auspices of the Central Government.

CHAPTER VII.

The Leather Footwear Industry.

136. The Industry may be divided into two broad sections. First, the making of the indigenous types of footwear and, second, the manufacture of that of the Western types. The latter may again be sub-divided into two branches, one making shoes by hand and the other by machine. The indigenous types are all, and the Western types in great bulk, hand-made. The industry, therefore is still preponderantly hand-worked, run mostly on a cottage basis. It thus differs radically from the modern shoe industries of Europe and America where mass production by machinery in big factories, is in vogue. Another characteristic feature of the Indian shoe industry is that the actual fabrication of all hand-made shoes, both of the indigenous and the Western types, is confined to the people of one caste, the *mochis*, and the bulk of the labour in the machine shoe factories has also to be recruited from that community. The industry's labour supply is thus inelastic. The marketing of the *mochis'* hand-made shoes is done through factors and shoe dealers. The wholesale dealers or shoe factors who pay advances to the *mochis* either in cash or kind often buy the latter's production and in such transactions, the *mochis* do not get proper values for their goods and cannot make much profit. There is a great deal of exploitation. On the other hand, a mochi taking advance from a dealer, often sells his goods to another dealer and delays or defaults on the repayment of his loan to his creditor. These *mochis* who work in shoe factories on wages often take advances from their employers; some of them turn disloyal and leave their employer without redeeming their debt and join a competing factory. Employers are also known to be prone to entice away skilled operatives of the competitors by paying higher advances. The industry is not yet well organised and the existing confusion constitutes a stumbling block in the way of its progress and development.

I. Indigenous types of foot-wears.

137. These comprise *Mundas, Nagras, Peshawari*, and *Jari* or embroidered shoes, sandlas, *chaplis* and *chattis* or half slippers. They are all of Indian origin in design and make and are fabricated from various types of leather produced in India. They are made all over India both in urban and rural areas, each province having its characteristic types. For instance, *Jari chaplis* and red sandals are mostly made and used in the Punjab while sandals and ordinary *chaplis* are made and used mostly in Western India. In N.-W.F.P. specially at Peshawar, Kohat and Bannu, large quantities of frontier *chaplis* are made. These are used locally and also exported to the Punjab.

138. The Central Agricultural Marketing Department estimated that before the last war about 70 million pairs of indigenous types of footwear were annually made in India. This is certainly not an over-estimate. Mr. Kaiser Ahmed estimates the present production at half a million pairs daily which is equivalent to an annual production of 150 million pairs or more than double the Agricultural Marketing Department's figure. But Mr. Kaiser Ahmed includes Alberts and New cuts in indigenous types of shoes which in this report have been classed as Western types of shoes. Mr. Raney, another member of the Panel, also says in

his note that in all probability the present production of civilian footwear by the cottage industry is more than 100 per cent above its pre-war level. Both Mr. Kaiser Ahmed and Mr. Raney are basing their figures on their experience in Bombay. Taking the whole of India into consideration it would, however, be safe to take the present production at 100 million pairs annually.

139. **Post-war expansion.**—As the coarser types of these footwear like *Mundas* are used by the poorer classes, expansion of their production would depend upon the post-war economic condition of these classes. Other types like *chaplis*, sandals etc., are used by the well-to-do and their popularity is increasing immensely. Only in urban areas, Western types of shoes are used. It is expected that the post-war production of indigenous types of footwear will increase. The Panel considers that by the end of the first 5 years, an increase of 100 per cent. over the present production would be feasible. But to attain this target, firstly, sufficient raw hide should be retained in the country for making cheap leather with a view to provide the poorer classes in India with cheaper shoes which are indispensible to them in many parts of India, and secondly, a large number of *mochi* shoe makers should be attracted to shoe-craft. Mr. Kaiser Ahmed advocated that the makers of the indigenous types of shoes should be taught modern foot anatomy and methods of lasting and making shoes and that cheap, hand-operated machinery should be made available to them on a co-operative basis to save labour and improve the products.

II. Western types of foot-wear.

140. These comprise Oxfords, Derbies, Albert slippers, New Cut selims and various types of ladies' shoes, principally for civilian use. Most of these are hand made by *mochis* working on their own on a small scale. A smaller proportion is hand-worked in shoe workshop which employ *mochi* craftsmen. The principal centres for hand-made shoes are Calcutta and Agra. The products of Messrs Cooper, Allen & Co., of Cawnpore bearing 'Flex Brand', Bata Shoe Co., of Calcutta and Lahore, Harijan Shoe Factory and Dayalbagh Shoe Factory and a few other factories at Agra, the Chrome Leather Co. of Madras, the Tara Shoe Factory of Bangalore and the India Leather Works of Calcutta are machine made. Of machine made shoes, those of Messrs Cooper, Allen & Co., and Bata, constitute the bulk. The military boots, other types of military footwear and Police boots also fall under this category. They are mostly machine made.

Expansion of Production.

141. From the figures of the present production of the Western types of shoes that the Panel has been able to collect and from estimates, it appears that the production has already reached the mark of about 30 million pairs annually. In the opinion of the Panel an increase of 50 per cent over this or an annual production of 45 million pairs would be a reasonable target for these types of shoes for the next 5 years. The present production of 30 million pairs of modern shoes will provide only 7½ per cent of India's 400 million people with a pair of modern shoes annually. In Europe and America about 3 pairs of shoes are required per person per year. As the use of modern shoes, among other things, is a proper index of standard of living and is extremely desirable for health, such a low standard of living and risk to people's health cannot be allowed to continue long. Mr. Kaiser Ahmed one of the members of the Panel suggests that a Department of shoe-wearing propaganda should be set up either by the Central or Provincial Governments and that the Government should try to popularise the shoe-wearnig habit by cinema films, posters, lectures and through post offices for the welfare of the people and their protection from snake bites and those diseases for which bare feet are responsible.

Need for Mechanisation.

142. Mass production of shoes by machinery in well equipped shoe factories such as exist in Europe and America and like those of Cooper, Allen & Co., and the Bata's should be encouraged. The production of shoes by hand process cannot be increased much further than what it is now because there is already an acute shortage of skilled *mochi* labour everywhere in India. *Mochi* labour is a veritable bottle-neck of the Indian modern shoe industry. The only way to widen this bottleneck is by taking help of machinery. In machine shoe factories men of other communities besides the *mochi* work readily as they are doing in Cooper, Allen & Co., and the Bata's. The witnesses examined by the Panel are unanimous in this view. Machine shoe making will not create unemployment among the *mochis*. The whole indigenous footwear industry is their monopoly. Many *mochis* will find employment in machine shoe factories and will have a better income and better conditions of living than they get from cottage work.

143. The cottage shoe industry itself may be progressively mechanised. In those centres as in Agra where large numbers of *mochis* are now making modern sroes in different Mahallas, auxiliary workshops equipped with a number of Singer sewing machines for upper closing, a few stitching and screwing machines and a set of finishing machines may be established. Cottage workers will be able to get uppers closed, the lasted shoes stitched or screwed and finished at these workshops, on payment of a suitable machining charge. This will enable them to increase their output and improve the finish. The Panel proposes that the Departments of Industries of U.P. and other provinces should investigate the matter and work out schemes for establishing such auxiliary workshops.

144. The existing hand shoe factories should also be progressively mechanised. From evidences taken at Agra by the Panel, it appears that many of these hand-made shoe factories are interested in mechanising. They should be given facilities by the Government for the importation of the requisite machinery. The Panel proposes that the Department of Industries and Supplies of the Government of India should request the provincial Industries Departments for lists of shoe making machinery required for their respective provinces. New machine shoe factories should be started at suitable centres where modern shoe production by hand or machinery has already developed to an appreciable extent.

Training in Shoe-craft.

145. The existing shoe-craft schools, as far as known to the Panel, are distributed as follows:—

In U. P.	5
In the Punjab	2
In Bombay	1
In Madras	1
In Bengal including Bata's School	2
Total	11

146. These are all very elementary schools. Excepting in the Dayalbagh Institute and Bata's school, the trainees do not get a chance of learning shoe manufacture by machinery. Considering that Agra, Cawnpore and Calcutta have developed into large shoe producing places, the Panel thinks that properly equipped and staffed Leather Craft Institutes should be established at these centres. They should have a set of shoe-making machinery so that the students may learn the technique of machine production. Operatives for the machines should also be trained there. Major Naville of the office of the C.I.S. and C.,

Cawnpore stated in his oral evidence to the Panel that to develop the shoe industry during post-war years, the most important requirement was to provide facilities for training technical personnel. He said that the training given in the existing institutes was inadequate. Mr. Kaiser Ahmed states that the existing shoe making schools should be improved so that small manufacturers may take an interest in them and obtain from them their technical personnel.

147. The Panel considers that research on shoes such as is being carried out at the British Boot, Shoe and Allied Trades Research Association at Kettering in U.K. is necessary and suggests that a Department for the purpose should be attached to the proposed Central Leather Research Institute.

Summary of Recommendations

148. (i) Targets for increasing the production of indigenous types of shoes by 100 per cent over the present level of production and increasing the production of Western types of shoes to at least 45 million pairs annually, should be aimed at during the first 5 years.

(ii) For this more and better leather should be produced by the tanning industry.

(iii) The shoe industry should be progressively mechanised. At first the hand shoe making factories at Agra and elsewhere should be equipped with machines. Auxiliary shoe stitching and finishing factories equipped with a set of machinery should be established at the existing cottage shoe making Mahallas at Agra and elsewhere and the Departments of Industries in U.P. and other provinces should investigate into the feasibility of establishing these auxiliary factories.

(iv) The Department of Industries and Supplies, Government of India, should request Provincial Departments of Industries for lists of machinery required for their respective provinces.

(v) New machine shoe factories should be established at suitable centres of the various provinces and facilities for the importation of machinery and capital goods from U.K., Europe and America should be given to them as well as to the existing factories.

(vi) The existing shoe institutes should be improved and a number of young men should be sent abroad with scholarships for training in modern footwear manufacture.

(vii) A Department for research in footwear should be attached to the proposed Central Leather Research Institute.

(viii) Shoe-wearing habit should be popularised by Government through cinema films, posters, lectures and post offices. This propaganda should be done by the proposed Department of Leather Industries of the Central Government (See Chapter XI).

CHAPTER VIII.

Leather Goods Industry.

149. The Leather Goods Industry may be divided into the following sections:—

(a) Civilian leather-goods.

(b) Industrial leather-goods.

(c) Police and military leather-goods.

(a) Civilian Leather-goods.

The different types of articles are described below:—

150. (i) **Travel goods** consisting of leather trunks, suit cases, fitted cases, attache cases, bags and portfolios. Hold-alls made of water proof canvas and fitted with leather straps are also included in this class because they are usually

made by these firms which deal in travel leather goods. They are all hand-made from leather produced in India. Better types of locks and other metal fittings were imported before the war and the common types were of local make. Indian locks are defective and need improvement. Other metallic fittings also leave much room for improvement. At present they are all of local production. Required leathers are available but with the exception of the products of a few tanneries, they are mostly crude. Attention, of the tanning industry is required for making properly dyed and finished case leather. Craftsmen are available who usually turn out a good job, but more of them are needed. In Europe and America a few machines have been invented for carrying out some operations involved in making these goods. Some of their bigger concerns utilize such machines but most concerns are mainly hand worked. In India it is entirely hand worked as yet. Accurate statistics of the present production could not be collected but there is a clear indication that production is increasing. Mr. H. Raney in his note says that production of travel goods in most of the concerns making them in Bombay, has increased by more than 500 per cent above the pre-war level. An export trade has already developed. In the quinquennium just before the war, the volume of export was as follows:—

Table No. XV

	Rs. lakh
1934-35	1
1935-36	4·1
1936-37	2·5
1937-38	3·1
1938-39	3·1

151. Demand for these are increasing and as these are almost an essential of modern life, the prospects in this line are unlimited like those of shoes. Air travel will reduce customers of a certain class but fresh categories of customers will come from ordinary people of whom more and more will use them. Besides, according to Mr. Raney, the demand for new types of articles for air travel has considerably increased. To cope with this demand, it is essential to make adequate arrangements for the supply of the necessary raw materials, fittings, etc. For the standardisation of travel goods, Mr. Raney suggests that arrangements should be made for the regular supply of suitable grindery, card-board, fibre board, lining materials, etc., through Government assistance.

The following targets appear to be feasible in respect of these goods.

152. 100 per cent. increase over the present production at the end of the first five years.

400 per cent. increase over the present production at the end of the subsequent 10 years.

Summary of Recommendations

153. (i) Tanning industry should make properly tanned and finished case leather. The stain and finish should stand wetting to which the leather is subjected during the fabrication of the cases.

(ii) Indigenous locks and metal fittings should be improved.

(iii) Cases should be standardised and for this purpose, arrangement for the supply of necessary raw materials should be made through Government assistance.

(iv) Export market should be developed.

(v) The above targets should be aimed at.

(ii) Ladies' Handbags.

154. They are all hand-made, the only machine used being the Singer Sewing machine. Two types are made. The first type, manufactured principally in Bombay, is made of chrome calf, suede, silver and gold kid and reptile skins, either of one kind of these leathers or in combination for effect. The other class which is manufactured notably at Santiniketan (Bengal) is made of tooled sheep skins tool marked and stained in various attractive designs. Most types of required leather are available from the Indian industry but the supply of leather of proper quality is inadequate and irregular. The ladies' handbag manufacturers like Lalvani Brothers, Raney & Co., and Gold Filled Leather Works of Bombay, drew the attention of the Panel to the problem of leather supply. Mr. Raney forcefully deprecated the export of the Madras tanned sheep and goat skins of better qualities from India, and in his note to the Panel suggested that the best selections of the Madras and Bombay tanned goat and sheep skins and light calves should be retained in India for the Indian Fancy Leather Goods industry. The feasibility of prohibiting the export of these leathers, was discussed at an earlier meeting of the Panel in Calcutta and the members present then thought that it should be possible for the Fancy Leather Goods manufacturers in India to get the leathers they want by direct negotiations with the tanners themselves, and without recourse, at this stage, to such a drastic step as the prohibition of export of these leathers altogether. At the final meeting of the Panel held in Calcutta, Mr. Raney reported that it had not been possible for him to get adequate supplies of high grade leather from the Madras tanneries. The matter may be investigated by the Government and after investigation, steps may be taken accordingly to ensure the supply of high grade leather to the ladies' handbag and other fancy leather goods manufacturers in India. The Panel realises that if a part of these leathers were retained in India, the quality of the Indian Fancy Leather Goods would be greatly improved. There is, however, a lack of designers. A few types of embossed and stamped leather are made but the requirement is for many more embossing and stamping designs.

155. Sheep skins required for the manufacture of the second type of bags are purchased from Madras. The best quality available in the Indian market is purchased, tooled and stained by the bag makers. A number of skilled craftsmen and women have been trained but more are needed. A large number of women are engaged in this trade in Bombay which has opened out an avenue of employment for widows and middle class women.

Post-war Development.

156. The war has given an impetus to the ladies' handbag industry in India. The American troops have been large customers for sending these goods home as presents. The quality of the bags made in India compares favourably with that of the bags which used to be imported into India before the war. In Bombay it was reported to the Panel that ladies' handbags valued at several lakhs of rupees were made yearly during the war period. Mr. Raney states in his note that the demand from foreign countries, is fairly large and is on the increase, but that it is mostly for handbags made of crocodile and water lizard skins. He suggests that a complete ban should be imposed on the export of crocodile and water lizard skins from India. The Government may investigate the feasibility of Mr. Raney's proposal.

157. Post war prospects appear to be good in view of the spreading of education among Indian ladies and their increasing participation in services and business as well as of the increasing possibilities of export market.

The following post-war targets are therefore suggested—

(i) 100 per cent. increase over the production attained in the peak year during the war by the end of the first 5 years.

(ii) 400 per cent. increase by the end of the subsequent 10 years.

Summary of Recommendations.

158. (a) The Indian tanning industry should specialise in the manufacture of high grade chrome calf, chrome and semi-chrome suedes and fancy leathers made from Madras tanned goat and sheep skins of the higher grades. They should develop the manufacture of Morocco, skiver for lining, gold and silver kids.

(b) The ancillary industry of engraving plates and die-sinking for embossing and stamping leather to produce several varieties of attractive embossed and stamped grains on leather, should be developed. Attractiveness, variety and changing of designs of the leather grain are the very soul of the ladies' handbag and other fancy leather goods industry. Men should be sent to Europe to learn plate engraving and die making. These are not yet done in India.

(c) Another ancillary industry of the bag and fancy leather goods trade, are frames and fittings. A beginning for the manufacture in India has been made in Bombay. But the workshops are all small and belong to the bag makers. Frame and fitting manufacture should be a separate industry which can be developed to a considerable extent. Until manufacture is developed in India, these goods should be allowed to be imported duty free in the interest of the Indian Fancy Leather Goods Industry.

(d) The industry for the manufacture of Zip fastener which has already been started, should be improved and developed.

(e) A number of Art Schools should be started in the country for the training of skilled workers for the ladies' handbags and other fancy leather goods industry, in view of the great dearth of skilled operatives for this industry.

(f) The feasibility of retaining a quota of high grade chrome calf and E. I. tanned sheep and goat skins for the Indian Fancy Leather Goods industry and of prohibiting export of crocodile and water lizard skins should be investigated by the Government.

(iii) **Small leather goods** *e.g.*, purses, wallets, note cases, photo frames, albums, cigarette cases, card cases, tobacco pouches, manicure cases, beauty cases, bed straps, waist belts, wrist watch bands, garment cases, garters, jewellery cases, fancy leather necklaces, etc.

159. These goods are made chiefly from Madras and Bombay tanned sheep and goat skins of lower grades which the manufacturers buy undyed and then stain and grain, emboss or stamp them. Most of the smaller articles are made from leather remnants. The industry appears to be supplying India's present needs. The demand is increasing because leather purses and wallets have already penetrated into rural areas and have become popular. There is a considerable demand for these articles in foreign markets. They are now made principally in Bombay and Calcutta. Prospects for development are good as more and more people will use the articles in India and export will also increase, provided adequate facilities for it are granted by the Government. The following targets appear to be possible:—

An increase of 200 per cent. over the present level of production, at the end of the first 5 years.

An increase of 600 per cent. over the present level of production at the end of the subsequent 10 years.

Summary of Recommendations.

160. (a) The tanning industry should retain, dye, grain and emboss Madras and Bombay tanned sheep and goat skins and supply them to the purse etc., manufacturers.

(b) Manufacture of high grade purses and wallets from suitable leather should be developed.

(c) More and better curried buffalo and cow harness leather for making the thicker bed strap should be made and supplied by the tanning industry.

(d) For waist band, well tanned, dyed and finished cow hides and for wrist-watch bands dyed and finished lighter leathers from calf, goat and sheep skins should be made and supplied by the tanning industry.

(e) Tariff protection should be given to the Handbag and Fancy Leather Goods industry in India against similar imported goods.

(iv) **Civilian Harness and Saddlery.**

161. Better as well as commoner types are made to meet requirements. Material and labour are available. Cawnpore is the principal seat of production. But they are made almost in all the cities to meet local requirements. Introduction of motor transport has reduced demand for these goods. There are very little prospects for expansion in future in this line.

(v) **Leather Sports Goods.**

162. These comprise the following articles:—

Football, Rugby ball, Volley ball and Base ball covers.

Cricket balls.

Hockey balls.

Grip leather for handles of Hockey sticks.

Leather base for shuttle cocks.

Football boots.

Leg guards.

Wicket keeping gloves.

163. They are made principally at Sialkot in the Punjab. The Panel visited the Sports Goods Factory of Messrs. Uberoi Ltd. There are a few other large factories like this firm. A great deal of sports goods is made by small manufacturers who work on a cottage scale. It was reported that sports goods valued at about Rs. 30 lakhs annually were made at Sialkot and leather worth about 6 lakhs of rupees was used by the manufacturers annually.

164. The products are sold in India but large quantities are also exported overseas. With the end of the war overseas trade will increase. The industry has immense prospects.

Summary of Recommendations.

165. (i) It is recommended that production be doubled during the first 5 years.

(ii) If required the Indian Trade Commissioners should help the marketing of these goods in overseas markets if the Sialkot manufacturers want such assistance from the Government. A big export drive should be initiated.

(b) **Industrial Leather Goods.**

(i) **Leather Machine Belting.**

166. A certain amount of leather belting is made from buffalo leather. The use of crude leather and the inclusion of shoulder in the strap, are responsible for the bad reputation of indigenous belting. A somewhat better grade is made from pit tanned buffalo sole leather. Here also the shoulder is included in the strap. A properly tanned and dressed Belting Butt similar to that used for

making belting in Europe and America is not generally made by the tanneries. But they can make it if demand arises. The Government Harness and Saddlery Factory, Cawnpore, according to Mr. Hepburn's evidence to the Panel, has been making quite satisfactory machine beltings upto 12" width. Mr. P. S. Pandit states in his evidence that he is making the leather belting in the Western India Tanneries Ltd., Bombay and the belting has been approved by the Sholapur mills and the tannery's belting dealers have entered into a year's contract with the mills. One great defect is that while imported belting is of cemented joints, the Indian made belting is stitched with leather lace. But Mr. Pandit thinks that this would be remedied after the war when chemicals for making leather cement would be available. Messrs. Cooper, Allen & Co., are of the opinion that Indian Buff hides are suited only for the narrow widths (upto 3"). Mr. K. H. Chambers in his evidence at Madras states that with the raw material in hand, India cannot turn out a first class leather belting and he agrees with Mr. Malvenan's note. Mr. Malvenan in his evidence states that belting such as is produced in England from the finest Scottish ox-hide cannot be made from Indian buffalo leather.

167. If however, well-made Indian beltings upto 12" width satisfactorily serve ordnance factories, there is no reason why they should not be equally satisfactory in the textile mills and other factories. The mills mostly require belts upto 4" in width and with the introduction now-a-days of individual drives of machinery in replacement of central line shafting drive in the progressive mills and factories, the demand in future will be more for belt upto 4" width than for those of greater width than this. So it appears to the Panel that well-made Indian buffalo leather belt will meet the need of the Indian industry and importation of leather belting upto 4" width would be unnecessary in future. The import figures for the quinquennium ending 1938-39 are given below:—

Table No. XVI.

	In lakh of rupees
1934-35	24·6
1935-36	24·7
1936-37	18·8
1937-38	27·5
1938-39	22·9

168. The industry, however, has to be stimulated by protective tariff. Mr. Inskip in his oral evidence at Cawnpore stated that he was of opinion that protective tariff against import of leather belting upto 3" might be imposed to encourage and stimulate the indigenous belting industry.

169. The Panel therefore recommends that by the end of the first 5 years, the production of leather belting should be increased by a quantity equivalent to the value of Rs. 19 lakhs at pre-war prices so as to replace about 75 per cent. of the pre-war imported belting. By the end of the following 10 years, there should be a further increase to the extent required by the Indian industry, and India should by then be able to dispense with all imported leather beltings except special ones above 12" in width.

Summary of Recommendations.

170. (a) Export of buffalo hides should be stopped lest those suitable for belting be sent out of the country.

(b) Flaying of buffalo hides should be improved because flay cuts reduce the tensile strength of the belting and make the hide unsuitable for making belting leather.

(c) Tanneries should specialise in making belting butt by appropriate processes of tanning and currying.

(d) Intensive research should be carried out at the proposed Central Leather Research Institute to select the most suitable types of buffalo hides and to work out processes of tanning and dressing Belting Butt so that they may approach as nearly as possible the ex-butt of the colder countries in tensile strength and un-stretchibility.

(e) Heavy import duty should be imposed first on leather beltings upto 4" in width and subsequently on those upto 12 " in width or a low ceiling price should be fixed in India for imported beltings.

(ii) **Picking Bands.** (This has been discussed in paras. 117-121).

(iii) **Picker:—**

171. Pickers are required for textile looms. They are not made of tanned leather but of limed buffalo hide. Much is imported but a certain quantity for cotton looms is made in India, particularly in Ahmedabad. The imported goods are reported to be better and more durable and consequently preferred. The import figures for the quinquennium before the war are given in the table below:—

Table No. XVII.

	In lakhs of rupees
1934-35	6·1
1935-36	6·9
1936-37	6·1
1937-38	8·7
1938-39	6·9

172. Expansion of the cotton picker manufacture has prospects but the Indian made jute loom pickers have not yet been approved by the Calcutta Jute Mills. From the progress already made by Bombay and Ahmedabad cotton Picker makers, it appears that a target eliminating importation of these by the end of the first 5-year period is quite reasonable. With the next 10 years after that, all cotton pickers required by the expanding cotton mills industry should be supplied by the manufacturers in India. Regarding jute pickers, effort is needed to make the Indian product acceptable to the Calcutta Jute Mills industry. Besides Ahmedabad, Bombay and Calcutta, pickers should also be made in the Punjab, U. P., C. P. and Madras where the cotton textile industry had developed appreciably.

Summary of Recommendations.

173. (a) Export of buffalo hides should be stopped to retain suitable hides for making pickers in India.

(b) Production of cotton pickers should be increased to eliminate their importation by the end of the first 5-year period.

(c) Intensive research should be carried out in the proposed Central Leather Institute on Jute Pickers.

(d) A heavy duty should be imposed on imported cotton pickers or a low ceiling price should be fixed in India to protect the Indian Cotton Picker industry and to stimulate its production.

(iv) **Buffers and Tuggers for looms.**

174. These are made by those concerns, for instance the Western India Tannery Co., Ltd., of Bombay which manufacture picking bands and pickers, as cuttings from these can be used for making buffers. Production is likely to increase further with the expansion of the textile industry in India. The target

should be so set that the entire requirements of India, may be met by domestic production. As those can be economically made only by those concerns which manufacture picking bands and pickers, their manufacture can only grow in those places where the latter too are made.

The Panel's Recommendation.

175. India's entire requirements should be met by local production.

(v) **Martingale straps and belt laces.**

176. Martingale straps are at present made in Calcutta, Bombay, Sholapur, Ahmedabad, Cawnpore and Madras. Demand for Martingale straps will increase with the expansion of the textile industry. But the demand for laces may decrease on account of the extended use of leather cement for belt joints.

The Panel's Recommendation.

177. The Panel recommends that the target for the first 5-year period be set, at about 100 per cent. increase over present production.

(vi) **Pump bucket, U rings etc.**

178. In peace time an appreciable quantity was imported but the locally made ones, particularly those made in Calcutta and Asansol colliery districts, are also used to a considerable extent by the railways, collieries, industrial concerns and the civilian public in domestic pumps. If the quantity of the local production is improved, it will be able to replace the imported goods entirely. This requires the supply of suitable hydraulic leather by the tanning industry to the bucket makers. The latter complain that buckets as hard as the imported ones, cannot be made from the local leather. Harder waxes than those used at present for impregnating the buckets are needed. A certain amount of research to turn out the right product is also necessary. If the present defects can be eliminated, there is a good prospect for this line. The target may be fixed at 100 per cent. increase over present production during the first 5 years.

Summary of Recommendations.

179. (a) Tanneries should pay attention to turn out hydraulic leather of desired quality for the bucket industry.

(b) Research should be carried out on leather bucket to turn out a product like the imported one.

(vii) **Railway leather stores.**

180. Among Railway leather stores axle box dust shields constitute the bulk. A certain quantity of leather cash bags is also required. The dust shields are made from pit tanned buffalo sole leather and cash bags from vegetable tanned cow hides. The bulk of the dust shields and cash bags are however made in Calcutta.

181. Post-war prospect appears to be good as the Railway rolling stocks will have to be replaced by new wagons which will require dust shields. The demand for cash bag may not however, be much greater than it was before the war. The production of dust shield may be increased by 100 per cent. over pre-war figure during the first 5 years.

The Panel's Recommendation.

182. The Government Harness & Saddlery Factory should not be allowed to make dust shields and compete with commercial firms.

(C) Military leather goods.

183. These are made and supplied by the Government Harness and Saddlery Factory. The factory produces its own leather which is 80 per cent. buffalo and 20 per cent. cow hide. Mr. Hepburn in his evidence states that the factory's output of harness leather (pre-war) was about 1 lakh pounds. This rose during the war to 6 lakh pounds per month. A smaller quantity of sole and belting leather was also produced. During the war, the requirements of military leather equipment increased enormously and the factory had to purchase leather from the trade. It purchased the entire output of 43 controlled tanneries. The quality of material as well as the workmanship of the products of the trade was about 50 per cent. below that of the Harness and Saddlery Factory's. The inferiority was due principally to bad workmanship caused by the lack of proper knowledge and supervision. No complaints, however, were received from the units during the war about the quality of the stores supplied. Major McBean said that in England whatever harness and saddlery was required by His Majesty's Government was supplied by the trade.

184. The Government Harness and Saddlery Factory was established at a time when the Indian tanning and leather goods industries were undeveloped and suitable leather and craftsmen and plants for making the leather goods to army specifications were not available in India. But during the last 80 years Indian tanning and leather goods industries have considerably developed Large tanneries have been started by Europeans as well as Indians. If the contractors who supplied military leather goods during the war, had got regular orders for military leather goods during peace time also, they would have had a chance of improving their workmanship. In England military leather stores are supplied by the trade. The Panel thinks that making of military leather goods should henceforth be thrown open to the trade and their manufacture at the Government Harness and Saddlery Factory should be stopped. This will give a tremendous impetus to the development of the Indian leather goods industry in the post-war period.

Summary of Recommendations.

185. (i) Production of military leather goods at the Government Harness and Saddlery Factory should be progressively reduced and totally stopped at the end of the first 5 years when the factory should be closed down. All the facilities that used to be given to the Leather Goods section of the Harness and Saddlery factory by its Engineering section should be given to the Industry by the Ordnance Department.

(ii) A number of Government military leather goods Inspectors should be appointed by the Government who would give technical guidance to the contractors with whom orders for military leather goods will be placed, and who will inspect them before delivery.

CHAPTER IX.

By-products Industries.

186. The industries which depend upon the by-products of the leather and leather goods industry are (i) glue and (ii) leather boards industries.

(i) Glue Industry.

187. A certain quantity of glue is made in India on a cottage industry scale also, in addition to the quantities made in factories. A considerable quantity of

glue was imported into and glue stock exported from India before the war. Figures for these during the quinquennium ending 1938-39 are given below.

Table XVIII.

Year	Import of Glue		Export of Hide & Skins Cuttings (Glue Stock)	
	Cwt.	Rs.	Tons	Rs.
1936-37	19,647	4,70,721	8,085	8,64,929
1937-38	17,289	5,95,336	10,370	10,38,059
1938-39	19,261	6,06,974	3,939	3,04,399
1939-40	19,418	7,24,719	3,668	2,92,225

188. Thus about 19,000 cwt. of glue valued at about 6 lakhs of rupees was imported before the war. A part of this should be made in India and export of hide and skin cuttings (glue stock) should be stopped. Colder climate like that in the Punjab and U. P. are naturally suitable for glue manufacture but now-a-days with facilities of air conditioning, it may be manufactured in Calcutta, Bombay, Madras and elsewhere also. Manufacture of glue should be increased by 10,000 cwt. yearly by the end of the first 5-year period.

(2) Leather Board Industry.

189. With the inevitable increase in the production of footwear to meet the growing internal and export demand and on account of the limited resource of buffalo hides in India, a shortage of bottom stock for footwear is apprehended within the period for which planning is being made. To meet this shortage as well as to provide Indian masses footwear at a price suiting their pockets, leather boards would be a very suitable material and stress should be laid on their manufacture in required quantities in India. Leather boards of different tensile strength, hardness, abrasion, resistence, waterproofness and thickness are being made in Europe and America and utilized for different component parts of the shoe for which their particular properties make them specially suitable. Thus there are specific boards for outer soles of house slippers, insoles, middle soles and throughs, heel lifts and stiffeners. The materials used for making them are small leather cuttings, and shavings of both vegetable and chrome tannages, wood fibres, colouring materials like aniline dyes, bonding materials like synthetic resins, such as acronal, molivith, etc. or synthetic rubber, latex and waterproofing material like bitumen.

189A. Large quantities of chrome leather shavings are inevitable by-products of chrome tanneries in India. These are at present either sold to manure manufacturers at a very low price or thrown away. These can be most usefully and profitably utilized for making leather boards. Similarly the chrome tanneries produce fair quantities of trimmings of chromed splits and dyed chrome leather. The shoe factories get large quantities of cuttings of both vegetable tanned sole and chrome tanned upper leather. All these can be profitably used for leather board manufacture. Machinery used consists of leather grinder, hollander and hydraulic press, none of which is complicated or unusually expensive. It would be advisable to instal pilot plants for leather board manufacture in leather trade institutes in India, carry out experiments for the production of boards for different purposes of the shoe industry, work out recipes for mixing the different ingredients and perfect the technique of manufacture. At present

leather board is being manufactured by Messrs. Cooper, Allen & Co. at Cawnpore. One or two firms are reported to be making it also at Agra. The boards are used for insoles of cheap shoes at Agra.

Summary of Recommendations.

190. (i) Stress should be laid on the manufacture of leather boards and their use in a proper way in shoe making in India with a view to meeting the apprehended shortage of bottom stock and to supply Indian masses footwear at a price suiting their pockets.

(ii) A pilot plant for leather board manufacture should be installed in the Leather Trades Institutes in India, where the technique of manufacture should be perfected.

(iii) By the end of the first 5-year period, production should be increased by 100 per cent.

CHAPTER X

Ancillary Industries

The following ancillary industries of the leather trade should be developed.

(1) Leather Trades Machinery Industry.

191. Indian tanning and shoe industries now use a lot of machinery which are mostly imported, principally from England. It should be possible to manufacture many of these in India. One firm in Lahore, one at Jullundur and two in Calcutta are making a few of the commonly used machines.

192. Use of tanning and shoe making machinery will steadily increase in future. For several years to come, it will be difficult to import machines from abroad; such machines will also be comparatively expensive. Consequently, locally made machines have a good chance of selling in India, at any rate, during the next few years until imported machines are readily available.

193. Manufacture of the less complicated tanning and shoe making machinery should be continued by the firms which have already started it and they should seek such Government assistance as they may need.

Summary of Recommendations.

194. (i) To develop the manufacture of leather trades machinery in India, the Government should subsidise or participate in the share capital of deserving concerns.

(ii) Government Ordnance Factories may be utilized for the manufacture of leather trades machinery.

(2) Leather Trades Treatment Materials Industry.

195. In Europe and America this industry manufactures such materials as synthetic bates, chrome liquors and chrome extracts, ready-made fat liquors, sulphonated oils, pigment finishes, cellulose lacquers, shoe dressings etc.

196. Some experiments have been carried out at the Bengal Tanning Institute and elsewhere on pancreatic bates, solid chrome extracts, fat liquors, and sulphonated oils. But their manufacture on an industrial scale has not been started. Four firms in Calcutta made pigment finishes for leather during the war and some of them are still making a certain quantity. Shoe polish, leather stain and dressings are made by a few firms in Calcutta and Agra. All these products are inferior to the imported ones and with the resumption of import the local products may be driven out of the market.

The Panel's Recommendation

197. During the first 5-year period, intensive research and manufacture in pilot plants should be carried out in the proposed Central Leather Research Institute to bring local products upto Western standards.

(3) **Last Making Industry.**

198. Shoe lasts were imported before the war but here and there carpenters made a few lasts to meet such demands as arose for the locally made lasts. Bata Co., at Batanagar have set up machinery for making wooden lasts and they use the lasts they make. Lasts are made at Sialkot and Jullundur, from sesum and mango wood by employing local carpenters.

199. The present difficulty in India in making lasts is the supply of suitable wood. Bata Co., state in their evidence that from their experience of the different types of Indian wood, they found it advantageous to import lasts. The life of Indian lasts compared to imported lasts is about 1 to 3.

200. Until suitable wood is found in India the last making industry will not make appreciable progress. It is reported that maple wood in blocks is imported into U. K. from canada for making lasts. Similar steps should be taken in India and the Government should arrange facilities for the importation of maple wood from Canada for the development of a last making industry in India.

Summary of Recommendations

201. (i) Investigation should be carried out at the Dehra Dun Forest Research Institute to find suitable wood, and until that is found, maple wood should be imported from Canada for making lasts.

(ii) The Government should make a special effort to secure last-making machinery.

(4) **Shoe Grindery Industry.**

202. The war stimulated the manufacture of a number of shoe grinderies in India. Mr. Wallibhai, President, Agra Shoe Manufacturers' Association stated in his oral evidence that all grinderies except tingles were manufactured in India and that the Indian shoe industry could do without imported grindery. Their quality was still inferior to the imported materials but it would improve if manufacturers get facilities for bulk manufacture in post-war years.

203. Consumption of grinderies will increase enormously and the grindery making industry should be stabilised with such Government assistance as it may need. The Government should assist the importation of machinery needed for making shoe grindery. Such machinery is not available in U. K. Attempt should, therefore, be made to get it either from U. S. A. or the continent of Europe.

Summary of Recommendations

204. (i) A thorough investigation should be made by the Government to ascertain how far the Indian grindery industry has developed during the war and it should be given every assistance, if necessary subsidy, for its stabilisation and further development.

(ii) The Government should assist the importation of machines for the manufacture of grindery from U. S. A. and the continent of Europe.

CHAPTER XI

Proposals for a Department of Leather Industries and a Leather Industries Council

205. In consideration of the pre-eminent position of the leather industries in the economy of India and their international character arising from the large

export of Indian hides and skins, import of tanstuffs and other materials they use and the overseas markets they need for the sale of their products, the Panel strongly recommends the establishment by the Government of India of a Department or Directorate of Leather Industries and a Leather Industries Council to look after their interests.

206. The main functions of the Department will be:—

(i) To organise the industries and to promote their development along efficient and progressive lines.

(ii) To prepare phased plans for their development as envisaged in the Government Directive.

(iii) To collect and maintain the statistics of the industries which is deplorably lacking at present.

(iv) To popularise by suitable propaganda the shoe wearing habit of the people of India for their health and protection against snake bites and other diseases for which bare feet are responsible.

(v) To do other things to keep the strength of the industries.

207. The Department should be constituted as follows:—

(1) It should be attached to the Department of Industries and Supplies of the Government of India.

(2) It should be under a Director whose designation would be "Director of Leather Industries." He should be an Indian with intimate knowledge and long experience of the Leather Industry.

(3) The Director should be assisted in his main function of promoting the development of the various branches of the industry, by specialists in those branches who should be appointed by the Government of India. The appointment of the specialists will be on a contract basis for a period of 3 years which may be extended if required. In case Indian specialists are not available they should be covenanted from the U. K. or U. S. A. or the Continent of Europe and their services should be lent to the industry to initiate the manufacture of new products and to improve the quality of those which are already being produced, to increase the competitive strength of the Indian leather industries in the overseas markets.

(4) The proposed Central Leather Research Institute should be under the development of the various branches of the industry, by specialists the headquarters of the specialists, should be at the Research Institute. The specialists, when not out on service to the trade, should work at the Institute in collaboration with its Director on the problems of the industry appertaining to their own special branches.

(5) The Director should also be assisted by the Leather Industries Council which should be appointed by the Government of India.

Constitution of the Leather Industries Council.

208. The Council should have the following constitution:—

Chairman—The Member or Minister in charge of the Department of Industries and Supplies.

Vice-Chairman—The Director of Leather Industries.

Secretary—An efficient whole-time permanent Secretary.

Members—Provincial Directors of Industries or the Leather Experts of the Provinces nominated by the respective Governments.

A representative of the Hides and Skins Trades of Calcutta, Cawnpore and Punjab.

A representative of the finished leather industry, one each from Calcutta, Cawnpore, Madras and Bombay.

Three representatives of the E. I. tanning interests in Madras.

A representative of the Tanners' Federation of India.

A representative of the South Indian Skin and Hide Merchants' Association.

A representative of the Bengal Tanners' Association and one from each of the other provincial Tanners' Associations as and when they are formed.

Three representatives of the Footwear Industry, one each from Calcutta, Cawnpore and Agra.

Three representatives of the Leather Goods Industry, one each from Bombay, Calcutta and Madras.

The question of suitably associating representatives of the Indian States with the Leather Industries Council should be considered by the Government.

209. The function of the Council should be to discuss and decide the policies to be adopted with regard to the development of the Leather Industries in India and to act as a liaison between the Government and the trade. Non-official members should be re-elected every three years.

CHAPTER XII

Answers to the General Directive

210. In the main report (Chapters II to XI), the types of products of the Tanning, Shoe and Leather Goods Industries, the manufacture of which is to be increased under the proposed scheme of development, have been discussed with reference to their present conditions of manufacture, effect of the war on production, prospects of further increase of output in the first 5-year period and in the following 10 years, and the targets to be aimed at by the end of these two periods and the Panel's recommendations for reaching the targets. In Chapter XI, a proposal for the creation of a Department of Leather Industries and a Leather Industries Council by the Government of India has been made. It is expected that the report embodies sufficient materials to enable the Government to prepare detailed phased plans for the 5-and 15-year periods for the development of Leather and Leather Goods Industries for the whole of India. In this Chapter, the Panel's views on the points of the Directive and on such other points which could not be incorporated in the previous chapters of the report are given.

211. (1) The scope and the extent of development.

The buk of India's raw hides and skins is already being tanned in the country and increasing quantities of footwear and other leather goods are being produced from the tanned leather to meet the growing demand. The scope of the Leather and Leather Goods Industry of India when all her hides and skins would be turned into footwear and other leather goods, which is very likely to come about in the course of the next 15 years, would be, in terms of money, an annual production valued at Rs. 130 crores, evaluating all leather goods on the common basis of footwear of the indigenous and western types.

The Industry's main products are leather, footwear and other leather goods. The various types of each of these have been exhaustively dealt with in the previous chapters.

1(A). It is estimated that just above Rs. 6 crores worth of machinery will have to be imported to equip the industries suitably and enable them to attain the targets set out.

(2) For the main branches, *viz.*, tanning, shoe making and leather goods making, Government ownership is not required. Rather in one case, *viz.*, the production of military leather goods, the Panel has recommended in the report that the present Government participation in it should be given up and the Government Harness and Saddlery Factory at Cawnpore should be closed down. The manufacture of these goods should be handed over to the industry which is competent to handle it. In the following subsidiary branches of the industry, the active participation or ownership of the Government is required:—

(i) Plantation of wattle in South India and elsewhere.

(ii) Plantation of *Babul* and *Avaram* trees.

(iii) Establishment of tanning extract factories.

(iv) Establishment of well equipped Slaughter Houses at different centres to improve flying.

The above lines of work have to be pioneered for the efficient development of the main industry and in the pioneering stage, private enterprise is bound to be shy and Government initiation, participation or part ownership, is necessary until such time as private enterprise takes them over.

(3) In the main branches of the industry, *viz.*, tanning, shoe making and leather goods manufacture, the whole of the capital required for their further expansion is likely to be available by public investment and Government assistance will not generally be required except in very undeveloped provinces in respect of the industries concerned.

(4) Technical advice from abroad will be necessary in the early stages as stated in Chapter XI. In the proposed Department of Leather Industries of the Government of India, foreign technical experts should be appointed until such time as qualified and experienced India technicians are available. Periodically, trade delegations and technicians for the industry should be sent to Europe, America and Australia to study the progressive methods of manufacturing and marketing. Students should be sent abroad with Government scholarships for technical training. The proposed Department of Leather Industries of the Government of India should keep contact with foreign Leather Industries Research Institutes and Federations to obtain technical and commercial information concerning the leather industry and pass over that information to the Indian Industry.

4 (A) There is a great dearth of the higher technical personnel in the tanning and machine shoe industries in India. Men having sufficient technical knowledge and experience to be able to take charge of large scale production of leather and shoes of adequate standards of quality are not available to the Indian section of the industries. The European tanneries, machine shoe and leather goods factories have such technicians who have been covenanted from the United Kingdom mostly. Technicians to work as assistants in tanneries and machine shoe factories, trained either at the existing tanning, shoe and leather goods making Institutes or in commercial concerns, are available. Future needs are for the higher technical personnel and Government assistance is required in the early stages so that commercial tanneries and shoe factories may get them from abroad or train suitable Indians for such work by sending them overseas with scholarships, from the existing superior grade personnel in industries. The Government should also arrange facilities for them to work in British, Continental and American tanneries and shoe factories to gain the necessary knowledge and experience.

(5) Co-operation with foreign firms is not necessary except to assist marketing. Technical assistance would be needed to find out special foreign requirements and needs, particularly in designs.

(6) The industry is old and different branches of it have already been localised at different centres. For the comparatively new industry of glazed kids manufacture, the best locations from the point of view of availability of suitable raw goat-skins, are Bengal, Bihar and Southern Madras. The industry for the manufacture of E.I. tanned kips, goat and sheep skins, which is now localised in South India should be spread out to provinces like Bengal, Assam, Orissa, C.P., U.P. and the Punjab where suitable raw hides and skins are available in sufficient quantities. In developing the tanning industry, particular attention should be given to those provinces where abundant raw materials exist but the industry is as yet inadequately developed.

(7) *Protective Duties*:—These are required mainly to develop and protect the manufacture of the following goods in India.

(i) Industrial leather goods like Picking Bands, Pickers, Roller skins and Leather Belting.

(ii) Glazed kid and suedes.

(iii) Shoes.

Bounties:—Bounties are immediately required to help the export of Indian chrome leather to U.K. where there is a ceiling price for it. Bounties in the shape of bonuses on price are being paid by H.M.G. to the Madras kip tanners to stimulate their production and export; this has raised the price of raw cow hides in India. The chrome tanneries have to purchase these hides in competition with the bounty-fed Madras kip tanners. This has raised the cost of production of Indian chrome leather to such a level that it cannot be sold at the existing ceiling prices for the leather in U.K. although there is a great demand for it in that country. Bounty should be given on exported chrome tanned kips, sides and calves to U.K. either by H.M.G. or the Government of India corresponding to the bonuses paid now by H.M.G. on E.I. tanned kips.

Research grant:—This is urgently needed. A Central Leather Research Institute on national scale should be established by the Government. Grants for research should also be made as required to commercial tanneries and provincial tanning Institutes for useful research.

Railway freight:—The Panel scrutinised the railway freight rates of leather footwear and leather goods, etc., collected by the secretary. It was found that they are mostly under the high classification varying from 4 to 6 in most railways. The Panel recommends that a reduction of the freight rates would stimulate the industry and recommends to the Government to bring that about.

7 (A). The relative incidence is about 2½%.

8. The Government should control the following:—

(a) Export of raw hides and skins. Export of buffalo and cow hides, and sheep skins should be totaly prohibited and that of goat skins restricted in accordance with the schedule given in para 38.

(b) The measurement of chrome leather should be controlled by legislative measures. (See recommendation No. 89 (vii).

(c) Starting of new tanneries, shoe and leather goods factories by foreign capitalists in India should be discouraged and controlled.

(d) The percentage of non-Indians and Indians in the higher technical personnel in non-Indian firms in this country should be controlled and the Indian personnel increased as more Indians become technically qualified. This will

act as a stimulus for promising Indians to join the leather and leather goods industry as they will find promising careers in it.

(e) The Chinese chrome tanneries in Calcutta should be controlled.

(f) The exploitation of cottage workers should be controlled. Absenteeism of the workers and non-payment of advances taken by them from employers should be controlled.

(9) There should be industrial associations for the different sections of the industry—Tanning, Shoe making and Leather Goods making sections. Each of these should have a provincial association which should be affiliated to an all-India Federation. There should be an all-India Federation for each section. The All-India Federations should be fully representative of all provinces and interests and be conducted on a democratic basis with conventions to secure proper representations to all interests. Cartel is considered to be unnecessary at this stage.

A census of tanneries, boot and shoe factories and leather goods manufacturing concerns all over India should be taken by the Government as early as possible with a view to give the industry an idea of their present stature and also to help formulation of a scheme for their co-ordination into associations and federations for the organised progress and development of the leather industry in India. The *chamars* and *mochis* working on a small scale should be organised by the provincial and state Departments of Industries, with proper facilities for supply of raw material and marketing of finished products.

10. Each sub-section of the tanning, shoe making and leather goods industries should be developed by planned programmes as to increased outputs, in which the interests of the entire industry should be considered. Too much development and production by firms which are better off, technically and financially, will militate against the spreading out of the industry and the interest of smaller concerns which are struggling to get on and establish themselves. Quotas of increased productions in programmes should be evenly distributed. This should be done by the proposed Department of Leather Industries of the Government of India in collaboration with the leather industries concerned. Assessment of possible demands for the various products concerned in the home and export markets should, of course, be the determining factor in making the programmes.

11. Yes. Until shoe wearing habit increases considerably in India, appreciable percentages of India's production of leather, shoes and leather goods will have to be exported to foreign markets. India now exports her raw hides and skins but her tanning industry has developed to such an extent that it can tan practically all her hides and sheep skins and a fair percentage of her goat skins producing leather of sufficiently high standards to be saleable in foreign markets. The same applies to her footwear and leather goods industries. Export market for these goods should be developed and free exports of E.I. tanned hides and skins, finished leathers, footwears and leather goods to all markets without any restrictions should be fostered and encouraged. An export organisation to popularise Indian footwear, leather and leather goods in foreign countries and exploit market possibilities there should be set up. In this connection, the organisation of the BETRO (British Export Trade Research Organisation) which has been recently established to encourage and foster British export trade, should be studied by the Government.

12. The industry should be developed both on cottage and factory scales but the latter will be more efficient in tanning and shoe manufacture. Machinery and technical assistance should be made available to cottage workers to speed up production and improve quality. Assistance should also be rendered to them for marketing their goods at economic prices and their exploitation should be controlled by Government as already suggested in 8 (f) above.

CHAPTER XIII

Materials and Personnel Budgets

212. Seven budgetary Statements given in this Chapter show approximately the total productions of the different items of leather, footwear and leather goods when the targets planned for the first five-year period are reached. They also show approximately the quantum of materials, machinery and technical personnel that will be required to attain those production targets. These figures are based on some production formulae. It must, however, be made clear that these formulae may vary and consequently the figures in the Statements must not be considered too rigidly and should be taken as rough approximations only.

213. Particular attention is drawn to Statement 2—Hides and Skins Budget—which shows clearly that when the first five-year targets are reached, there will be an absolute shortage of buffalo hides in relation to internal demand alone. There will also be no surplus of cow hides and sheep skins for export as raw. The Indian tanning industry will need them all. At the end of five years, there will be a surplus of 26.4 million goat skins, the disposal of which is proposed as follows:

13·8 million fine grained skins to be exported as raw.

2·3 „ „ „ „ as glazed kid.

10·3 „ „ coarse „ „ as E. I. tanned.

214. The position of buffalo hides is disconcerting. These are essential for sole leather and also for leather belting, picking bands, raw hides, pickers and tuggers, martingale straps and military equipment. It is estimated that India's available 6.2 million buffalo hides would be disposed of as follows (Statement 4).

	Million
Pit tanned & compressed sole and also bag-tanned sole for Western types of foot-wear.	3·06
Bag-tanned sole for indigenous types of foot-wear and some pit-tanned soles for sandals.	2·80
Civilian harness	0·03
Leather machinery belting	0·20
Picking bands	0·05
Raw hide pickers	0·10
Martingale straps	0·05
Military leather goods	0·10
Total	6·39

215. The above estimates are conservative rather than lavish and even at that there will be a small deficit at the end of the first five-year period. After that when footwear production will inevitably increase with increased demand from the Indian masses and when there will be equally increased demand for such industrial leather stores as leather belting, picking bands, pickers, laces and for railway leather stores such as dust shields, pump buckets, U rings, etc., and for military leather equipment for India's army, an acute shortage of buffalo hides in India is apprehended. India should prepare herself for this emergency. More buffaloes should be bred and consumption of buffalo leather economised. Some economy is possible if leather boards are utilized for insoles of utility shoes at least and leather and other types of boards for stiffeners of all footwear. Manufacture of leather boards should be developed in India (*vide* para 189).

216. A small surplus of 3.5 million cattle hides is expected after meeting India's various needs for cattle hide leather at the end of the first five-year period. This surplus will be exported partly as E.I. tanned kips and partly as box sides, box kips and box calf during and for some time after the first five-year period. But with increased demand for shoes from the Indian masses, India will need progressively more of cow hide leather for shoe uppers and at the end of fifteen years it is very doubtful if India will be able to export even cow hide leather either as E.I. tanned kips or chrome. India should prepare herself from now to increase her cattle population and use her cattle more rationally to get maximum possible yields of hide and meat. If cattle were not allowed to linger on to old age and were slaughtered earlier, much higher yields of hide and meat would be obtainable even from India's existing livestock population. Although at present compared to other countries of the world, India's livestock population is high the percentage of hide yield on livestock is low as will be clear from the following table:—

TABLE XIX.

Production of slaughtered hides in different countries in the world.*

Country	Cattle population (lakhs)	Annual production of hides (lakhs)	Percentage of hide production to cattle population	Percentage of hide production to world total
(1)	(2)	(3)	(4)	(5)
AMERICA—				
United States of America . .	664	243	36·6	17·8
Canada	88	19	21·6	1·4
Argentina	309	60	19·4	4·4
Brazil	405	42	10·4	3·1
Other South American countries (a)	347	39	11·2	2·9
				29·6
EUROPE—				
U. S. S. R.	565	247	43·7	18·1
Germany	201	83	41·3	6·1
France	158	77	48·7	5·7
Poland	101	35	34·7	2·6
Italy	72	30	41·7	2·2
United Kingdom	86	29	33·7	2·1
Other European Countries (b) .	458	118	25·8	8·7
				45.5

* Abstracted from "Statistical Year Book of the League of Nations" 1937-38 and the "Leather Trades' Year Book", 1937.

(a) Cuba, Mexico, Chile, Columbia, Peru and Uruguay.

(b) Austria, Belgium, Bulgaria, Denmark, Spain, Estonia, Finland, Hungary, Ireland Latvia, Lithuania, Norway, Netherlands, Portugal, Rumania, Sweden, Switzerland, Czechoslovakia, and Yugoslavia.

Country (1)	Cattle Population (lakhs) (2)	Annual production of hides (lakhs) (3)	Percentage of hide prodnction to cattle population (4)	Percentage of hide production to world total (5)
AUSTRALIA	139	25	18.0	1·8
NEW ZEALAND	43	14	32.6	1.0
AFRICA (c)	227	21	9.2	1·5
ASIA—				
Other Asiatic countries (d)	118	17	14·4	1.2
India	2,235 (e)	257 (f)	11.5	18.8
Burma	61	8	13·1	0.6
				2·49
Total	6,277	1,364	21·7	(100)

(c) Algeria, Egypt, Madagascar, Morocco (Fr.), S. Rhodesia, Tunis and Union of South Africa.

(d) Korea, Formosa, Indo-China, Japan, Palestine and Philippines.

(e) 1,760 lakh cattle and 475 lakh buffaloes.

(f) 200 lakh kips and 57 lakh buff hides. The number includes fallen hides also In most other countries, production of slaughtered hides constitute by far the bulk of the t otal.

217. It will be seen from the Statement above thaot in Germany the yield is as high. 48·7% and in most countries in Europe and America where cattle are rationally utilized, the yield is between 20 and 40%. Only in India, Africa, Brazil and all other South American Countries excepting Argentins, the yield is about 10%. In India this is principally due to the strong prejudice against cow killing. If this prejudice could be broken down and India's cattle population rationally utilized by establishing a meat industry catering to domestic and foreign markets, such as exists in other countries, India's hide supply would be substantially increased, probably doubted.

218. In statement 3 (Materials Budget for tanning—other materials) attention must be drawn to India's shortage of vegetable tanstuffs. India's total requirement when the planned targets of leather production are reached at the end of the first five-year period would be 63,147 tons of wattle bark (or 85,782 tons *babul* bark plus 69,106 tons of *avaram* bark) and 36,322 tons of *avaram* bark, 187,600 tons of *babul* bark, 15,134 tons of myrobalans and 1,170 tons of tanning extracts together representing about 56,418 tons of tanning on pure tannin basis. India imports practically all wattle bark and all tanning extracts except myrobalan extract which she uses at present. India will have to import more when leather production will be increased according to plan. India's tanning shortage could be partially made up, period of tanning shortened and leather quality improved if synthetic tannins were manufactured and used in India.

219. In statement 5 (Machinery budget) it will be observed that machinery of the value of Rs. 6 crores will have to be imported, principally from U.K. Manufacturers of tanning and boot and shoe machines both in U.K. and U.S.

however cannot promise any deliveries in less than two or three years. A lot of leather trades machinery may however be available as reparations quota for India from Germany. The Panel suggests that a list of such machinery as the Indian Leather Industry may be interested in getting from Germany be prepared and be sent up to the India Supply Commission in London who would try to get them for India.

220. In statement 6, it will be observed that the aggregate personnel required to reach the targets of the first five-year period will be 2,300 for administration, 10,000 for higher and 33,000 for lower technical work excluding unskilled labour. During the first five years, administrative and higher and lower technical personnels to be annually trained to attain the recommended targets of production, and including normal annual replacements, are estimated to be 190, 900 and 3,800 respectively.

APPENDIX TO CHAPTER XIII

STATEMENT I.—Production Targets

Leather Targets

Leather from Hides.

1.	Bag tanned sole leather from buffalo hides	36·5 lakh hides.
2.	Pit-tanned ditto	21 ,, ,,
3.	Chrome tanned picking band and lace leather from buffalo hides.	0·5 ,, ,,
4.	Bag and other crudely tanned cow hides	59 ,, ,,
5.	Half tanned E. I. kips from cow hides and buffs	86 ,, ,,
6.	Chrome tanned Box sides and calf from cowhides and calfskins	58 ,, ,,
7.	Vegetable tanned in pits (pit tanned cow hides for case leathers)	6 ,, ,,

Leather from goat and sheep skins

8.	Vegetable tanned leather from sheepskins	200 lakh skins.
9.	Ditto from goat skins	121·2 lakh skins.
10.	Chrome tanned glazed kid and suede from goat skins	41·4 lakh skins.

Footwear Targets

11.	Indigenous types e. g., Nagras, Mundas made principally from bag and crudely tanned cow hide uppers and bag tanned buffalo and heavy cowhide sole and sandals chaplis and half slippers made partly from chrome tanned cow hide and partly from bark tanned cow and buff calf (Katai) uppers and mostly from bag tanned and to a smaller extent from pit tanned pressed buffalo sole	200 million pairs.
12.	Western types e. g. Oxfords, Derbies, Civilian and army boots, Alberts, Newout selims, etc. and ladies' shoes made mostly from chrome tanned cowhide (boxsides) and to a smaller extent from glazed kid and chrome sheep skin uppers and pit tanned pressed as well as bag tanned buffalo sole.	45 million pairs.

Leather Goods Targets

13.	Travel goods e. g. leather trunks, suit and attache cases, portfolios, etc. made mainly from vegetable tanned cow hides and to a small extent from vegetable tanned goat and sheep skins.	20 lakh pieces in terms of 22" suit case.
14.	Ladies' hand bags made from chrome tanned calf and kip, vegetable tanned fancy leathers from goat and sheep skins and leathers from such reptiles as crocodile, snakes and lizards.	4 lakh pieces.
15.	Small leather goods e. g. purses, wallets, wrist watch bands, etc. made mostly from vegetable tanned goat and sheep skins and leather cuttings.	40 million pieces.
16.	Civilian saddles made from vegetable tanned (either by bag or pit process) buffalo hide curried into harness leather.	4,000 pieces.
17.	Leather sports goods, e. g. football, cricket and hockey ball etc. covers and sundry goods made mostly from bag tanned cow hides and in case of hockey ball from alum tanned cow hides.	6,000 cow hides required (estimated)
18.	Machine belting from leather made from vegetable tanned buffalo hides	2 lakh hides required (estimated)
19.	Roller skins made chiefly from vegetable tanned sheepskins	5 lakh pieces
20.	Raw hide Pickers made from buffalo hides	1 lakh hides required (estimated)
21.	Martingale straps, laces for belting, pump buckets, U rings and miscellaneous Railway leather stores e. g. axle box dust shields etc. made from buffalo and cow hide leathers	Half-a-lakh cow and buffalo hides required (estimated)
22.	Military leather equipment made mostly from pit tanned buffalo hides curried into harness leather	1 lakh hides required (estimated)

STATEMENT 2

Material Budget—Hides and Skins

(in million pieces)

Description	Available stock including normal import	Expected internal consumption according to recommended targets for footwear and other leather goods	Anticipated deficit (—) or surplus (plus)	Remarks
Buffalo hides . .	6·2	6.39	—0·19	Small deficit. Export should be totally prohibited.
Cow hides . .	20·5	17·0	+3·5	This surplus will be exported partly as E. I. tanned kips and the remaindor as box sides.
Goat Skins . .	30·0	3·6	+26·4	Of the surplus 26·4 mn 13·8 mn of the fine grained goat skins will be exported as raw. Of the balance, about 2·3 mn (of 3 mn production) of glazed kid will be exported. The remainder 10·3 mn will be exported as half tanned.
Sheep Skins . .	20·0	11·5	+8·5	The entire Surplus of 8·5 mn will be exported as half tanned.

STATEMENT 3

Consolidated quantities of principal tanning materials, etc. required to achieve the leather targets.

(in tons)

Wattle bark	63,147 (or Babul bark 85,782 plus Avaram bark 69,106).
Myrobalan, ...	15,134
Avaram	36,322
Babul	187,600
Sodium Sulphide	1,280
Lime	47,544
Soda Ash	300

	(in tons)
Caustic Soda	10
Titanium Oxide	4
Titanium Potasium Oxalate or Titox (if used by all chrome tanners in chrome upper leather manufacture)	120
Boric Acid	1,131
Oxalic acid or syntan (for bleaching)	286
Sulphuric Acid	4,013
Acetic Acid	60
Hydrochloric Acid	234
Salt	8,431
Hypo	624
Bichromate of Soda	3,133
Bicarbonate of Soda	8
Pancreol 3A	189
Pancreol 5A	35
Borax	804
Ammonia	36
Ammonia chloride	12
Hematin	94
Negrosin	13
Formalin	86
Paraffin and other waxes	1,000
Glycerine	156
Sulphonated castor oil	651
Fish oil, sesame, groundnut, linseed oil etc.	6,000
Spindle oil	156
Neatsfoot oil	31
Castor oil	16
Ready made fat liquor	373
Tanning extracts solid	1,172
Fustic extract	78
Black dye	160
Brown dye	165
Yellow dye	1
Gambier	155
Black pigment	136
Brown pigment	210
White pigment	4
Tallow	1,500
Molasses	876
Binder	144
Glazol	144
Reh or Sajji	2,009
Soap	50
Blood	39
Milk	83
Egg albumen	equivalent of 4·5 million eggs.
Para nitrophenol and other disinfectants and antimoulds	1
Whiting	25
Epsom salt	500
Glucose	725

	(in tons)	
Sodium bisulphite	16	(for sulphiting ordinay quebracho extract).
Sodium sulphite	12	
Nitrocellulose lacquers	1,000	Gallons
Thinners	1,500	Gallons

STATEMENT 4.

Quantity of Principal Materials required to attain the recommended foot-wear targets.

I. Western types of shoes.

Chrome upper leather	0·8 mn. goat skins 3·6 mn. cow hides.
Lining, sheep skins	9·6 mn. pieces.
Canvas for lining	4·5 mn. yds × 27".
Sole leather for bottom stock	3·06 mn. buffalo hides.

Grindery :—

Thread for upper	9 mn. reels.
Eyelets	720 mn.
Rubber solution	301 tons.
Tacks (½" × 5/16")	500 tons.
Blue tacks	300 tons,
Brass rivets	340 tons.
Sprigs	100 tons.
Sewing thread 5-6 chord	200 tons.
Stitching ,, 10-12 ,,	280 tons.
Brass wire	200 tons.
Staple taking wire	200 tons.
Sand paper (carborandum)	22·5 mn. yards.
Heel balls	15·7 mn. pieces.
Polishes	200 tons.
Sole polish	675,000 gallons.
Cleaning acid	100 tons.
Heel attaching nails	1,000 tons.

Total cost of grindery for 45 mn. pairs—Rs. 4·5 crores.

II. Indigenous types of shoes.

Chrome upper leather	1·6 mn. hides.
Bark tanned uppers	6 mn. hides.
Sole leather for bottom stock	2.8 mn cow hides. 2·8 mn. buff hides.
Leather lace for stitching *munda*, *nagra* and *chati*.	0·8 mn. cow hides.

Grindery :—

Thread for sandal upper	4 mn. reels.
Tacks for sandals	450 tons.
Bifurcated rivets	200 mn. pices.
Rubber solution	450 tons.
Cotton thread	450 tons.

Quantity of leather required to attain the Other Leather Goods targets.

2. Travel goods	2 mn. cow hides.
3. Ladies, hand bags	1 lakh goat skins 1 lakh sheep skins. 50,000 calf skins.
4. Small leather goods	27 lakh goat skins. 18 lakh sheep skins.
5. Civilian harness leather	1¼ lakh cow hides. 3000 buff-hides.
6. Leather sports goods	60,000 cow hides.
7. Leather machine belting	2 lakh buffalo hides.
8. Cotton pickers	1 lakh buffalo hides.
9. Martingale straps etc.	50,000 buffalo hides.
10. Military leather goods	1 lakh buffalo hides.
11. Picking bands.	50,000 buffalo hides.

STATEMENT 5.

Machinery Budget.

Cost of Machinery to be imported.

I. Footwear.—Of the present output of 30 mn. pairs of western types of shoes, it may be taken that the existing stock of machinery is adequate for only about half of them. Additional machines will be required therefore for renewal and modernisation in respect of 15 mn. pairs of the present production in addition to another 15 mn. pairs which are the proposed targets for expansion of production. Shoe machinery will therefore be required for an annual output of 30 mn. pairs. This will have to be imported over five years at a capital cost of Rs. 8,25,68,000 at current quotations (including cost of prime movers).

II. Glazed Kid.

Cost of machinery to be imported will be Rs. 8·2 lakhs.

Cost of prime movers will be an additional Rs. 90,000.

III. Box sides and calves.

Cost of machinery to be imported will be Rs. 1,66,16,000.

Cost of prime movers will be an additional Rs. 17,01,000.

IV. Pit tanned Sole Leather.

For the equipment of those tanneries making pit tanned sole leather which have not yet got machines and for supplementing the machinery of those which are still inadequately equipped and for renewal and replacement of worn-out machinery of the other tanneries, the machinery to be imported for pit tanned sole leather production is estimated to cost Rs. 20,83,200.

Cost of prime movers will be an additional Rs. 4,41,000.

V. Machinery to be imported by half tanned kip tanneries for modernisation will cost Rs. 10,13,760.

Cost of prime movers will be another Rs. 2,64,000.

Ditto by half tanned skin tanneries will cost Rs. 1,76,000.

Cost of prime movers will be another Rs. 54,000.

estimating that in either case, only 25 per cent. of the tanneries will go for machinery within the first five-year period.

VI. Machinery to be imported by Other Leather Goods industries will cost about Rs. 60 lakhs.

Total cost of machinery to be imported over the first five-year period will, therefore, be just over Rs. 6 crores including cost of prime movers.

STATEMENT 6

Personnel Budget (Aggregate)

Total personnel required at the end of five years to attain the targets.

Description	Administrative personnel	Higher Technical Personnel	Lower technical personnel excluding unskilled manuel workers
1. Pit tanned buffalo leather . . .	140	700	1,470
2. E. I. tanned kips . . .	286	1,287	2,288
3. E. I. tanned goat and sheep skins .	218	981	1,744
4. Chrome tanned cow hides and calf skins	200	1,200	3,500
5. Glazed kid and chrome suede . .	22	132	389
A. Total Leather	*866*	*4,300*	*9,391*
B. Footwear	*300*	*2,100*	*13,500*
Other Leather Goods	*1,100*	*3,100*	*19,800*
Grand total (in round figures) . .	**2,300**	**10 0**	**33,000**

STATEMENT 7

Personnel Budget (annual)

(Personnel to be trained per annum during the first five year period for expansion and replacement).

	Administrative personnel	Higher technical personnel	Lower technical personnel excluding manuel workers
A. Leather	37	238	674
B. Footwear	26	304	1,950
C. Other Leather Goods	128	361	1,150
Total (in round number) . . .	**190**	**900**	**3,800**

CHAPTER XIV

Delegations of Technicians and Businessmen to Germany and Japan

Germany :

221. The German leather industry was reputed before the war for the quality of its box calf, box sides, patent and upholstery leather and fancy leather goods. The German chemical industry is reported to have produced a number of materials such as disinfectants, soaking agents, synthetic bates, synthetic tanning agents, synthetic fats, oils and fat liquors, pigment finishes, cellulose lacquers, shoe and leather dressings, leather boards and artificial leathers for sole and other purposes, which are all useful for the leather and leather goods industries of India. It is reported that since the conclusion of the war, facilities have been offered to the Allied countries to send technical investigators to Germany for studying industrial processes. It appears that several investigators have already been there, as reports have been published and made available to the public. A few reports on the German leather industry are also among them.

222. The Panel considers that it is a unique opportunity for the Indian leather and allied industries to get a knowledge of the techniques of production of German leather, leather goods and leather treatment materials and suggests to the Government of India that qualified Indian leather technicians and chemists should be sent to Germany in adequate numbers as technical investigators for the leather industry. It is known that a few investigators were sent already but in the opinion of the Panel a lot more should be deputed to exploit the available opportunities in the interest of the Indian leather industry. The persons to be sent should be all Indians. The Panels recommendations on this subject are as follows:

(1) At least four leather technicians should be sent to study the techniques of German leather production.

(2) At least three highly qualified Organic Chemists should be sent to study the production of synthetic tanning agents.

(3) At least two qualified Cellulose Chemists should be sent to study the technique of the production of sulphite cellulose extracts and leather boards.

(4) At least two Leather Chemists should be sent to study the techniques of the production of pigment finishes, cellulose lacquers, leather and shoe dressings.

(5) Two Leather Chemists having previous knowledge of the subject should be sent to study the technique of the production of synthetic bates.

(6) Two Organic Chemists should be sent to study the technique of the production of synthetic fats, oils and fat liquors.

(7) Two Organic Chemists should be sent to study the technique of the production of disinfectants, soaking agents and other chemical leather auxiliaries.

(8) Two Organic Chemists should be sent to study the technique of production of leather substitutes.

(9) Two Leather Chemists should be sent to study the technique of the production of tanning extracts.

(10) Two boot and shoe technicians should be sent to study the technique of the German shoe industry.

(11) Two fancy leather goods technicians should be sent to study the technique of the German leather goods industry.

(12) Two mechnical engineers should be sent to study the technique of the production of engraved plates, frames and fittings for the fancy leather goods industry.

(13) Two mechanical engineers should be sent to study the manufacture of tanning machinery and spare parts of machines.

(14) Two mechanical engineers should be sent to study the manufacture of shoe machinery and spare parts.

(15) Two mechanical engineers should be sent to study the manufacture of shoe grindery and machinery for them.

(16) Two mechanical engineers should be sent to study the manufacture of shoe lasts.

(17) Two leather chemists having previous knowledge should be sent to study the technique of glue and gelatine manufacture.

(18) Two Leather Chemists should be sent to study the technique of the utilization of hair obtained as a by-product from tanneries.

(19) Two Leather Chemists should be sent to study the technique of recovering chrome from waste tannery chrome liquors and for the manufacture of chrome salts like bichromate, chrome alum, chrome tanning extracts, etc.

The Panel's recommendation.

223. A total of 41 technical investigators (enumerated in para 222) who should be selected by an expert Committee consisting of representatives of the Government and the trade, should be sent to Germany immediately to study German techniques and processes for the benefit of the Indian industry.

Training Indian Technical Scholars in Germany.

224. The 41 technical investigators suggested above will go to Germany for periods varying from 6 to 12 weeks. Apart from them a few, say 6 students, who have already been awarded or who may be awarded technical scholarships for studying leather industry under the technical scholarship scheme of the Government of India may be sent to Germany and apprenticed in German commercial tanneries or admitted to the Leather Trades Institute in Germany. They may remain and study there for 1 or 2 years. This will partially solve the difficulty which is being experienced now in finding accommodation for the selected scholars in tanneries and trade institutes in U.K. and U.S.A. which are now overcrowded with demobilized military personnel of those countries. Some of these scholars have been waiting for accommodation for over a year or so.

Japan:

225. Facilities for technical investigation may similarly be available in Japan. It is true that Japan was never known to have a leather industry of repute. Nevertheless, before the war, Japan used to import Madras tanned sheep and goat skins and made fancy leather goods from them. Japan used to manufacture also vegetable tanning extracts and such tanning chemicals as bichromate of soda and sodium sulphide. India used to import fair quantities of Japanese bichromate and sodium sulphide in the pre-war days. Before the war, the production of canvas and rubber shoes was a well-known industry in Japan. There must also be a tanning industry of some sort in Japan which may be worth investigating. The Panel, therefore, is of the opinion that a few technical investigators should be sent to Japan as well.

Summary of Recommendations.

226. (i) At first two Indian leather technicians should be sent as pioneer investigators to Japan to survey its leather and allied industries. On their return and report, if it be worthwhile, the following investigators should be sent:

(1) Two investigators for the Fancy Leather Goods industry.

(2) A Leather Chemist to study manufacture of tanning extracts.

(3) Two investigators who should be qualified in organic chemistry to study the manufacture of bichromate and sodium sulphide.

(4) Two investigators having previous knowledge of the subject for canvas and rubber shoes.

(5) Two investigators who should be leather technicians to study the tanning industry.

(ii) The investigators should be selected by the same Expert Committee proposed for those to be sent to Germany.

Delegation of businessmen to Germany and Japan.

227. Apart from technical processes, for which technical investigators and students have been recommended to be sent, there may be much on the administrative and business sides of the industry in Germany and Japan which may also be worth investigation and study. For this the Panel recommends the following:

Summary of Recommendations.

228. (i) A delegation consisting of 3 groups of businessmen representing respectively the Tanning, Footwear and Leather goods industries should be sent to Germany. Each group should consist of 5 businessmen nominated by the provincial associations of the principal centres of these industries in India.

(ii) On return and report of the pioneer investigators mentioned in para 226 (i), a similar delegation should visit Japan.

(iii) The delegation of the businessmen to Germany should be sent forthwith but that to Japan should be sent only on return of the pioneer investigators mentioned in para 226 (i).

APPENDIX I

Department of Planning and Development

General Directive to Industrial Panels.

It is the function of panels to make recommendations to Government regarding the development of industries, both existing and new. These recommendations should be so framed as to enable Government to prepare a detailed phased plan for the five years following the cessation of hostilities, as the first stage of a 15-year plan of industrial development for the whole country.

2. In order to assist them to formulate recommendations, panels will be supplied, as far as possible, with factual information prepared by the panel secretaries. In the case of new industries, the information will consist of a general survey of the industry and the importance of starting it in India, the availability of raw material, the power requirements, the demands of the Indian markets and the probabilities of exports. In the case of existing industries, the information will naturally be more comprehensive; it will indicate in addition, the location of existing units, the types of goods produced, the total production under each category and the assistance, if any, given by Government. These items are to be regarded as illustrative and not exhaustive.

Government will give each panel, as a basis, for discussion, the provisional target to be aimed at in the first five-year period and, wherever possible, of the target to be reached in 15 years.

3. The recommendations of the panels should cover the following points :—

(1) The scope and extent of development, including the type of products recommended.

(1-A) The estimated requirements of capital goods together with such details of these requirements as may be available in India and how much should be imported from abroad.

(2) Whether the industry should be under Government ownership either on grounds of national interest or because private capital is unlikely to take it up, and if so, whether it should be wholly or partly managed by Government.

(3) In the case of industries to be developed other than under State ownership, the capital required for such development, whether the whole of it is likely to be available by public investment and, if not, the extent to which Government assistance may be required.

(4) The extent to which technical advice from abroad may be necessary.

(4-A) The availability and the future requirements of technical personnel so as to obtain a clearer indication of the present short-comings and future needs.

(5) The manner and the degree of co-operation with foreign firms considered necessary and desirable, both as regards capital and management.

(6) The location of the industry.

(7) The nature of the assistance required from Government in the form of protective duties, bounties, research grant, export advice, etc.

(7-A) The relative incidence of the import duty on the finished goods in comparison with the duty on the raw materials from which they can be manufactured.

(8) If the industry is to be under private ownership and management, what controls, if any, should be exercised by Government.

(9) What should be the organisation of the different units of the industry, *e.g.*, should there be an industrial association? Would a cartel be desirable?

(10) The stages by which the industry should be developed,

(11) Should the industry cater for the export market?

(12) Should the industry be developed, as in Japan, on the cottage industry basis and, if so, to what extent?

4. Although, as stated above, the panels may recommend the grant of protection, it will not be their function to consider broad questions of international trade and commercial policy.

5. Joint meetings of the panels should be held, wherever necessary, to secure co-ordination particularly where the processes and the products of one industry are connected with those of another.

6. Some of the panels have been drawn broadly and it may be necessary to co-opt members for dealing with specific branches of the industry. Members may be co-opted by the Chairman in consultation with the Industrial Adviser.

7. Before submitting recommendations, panels should consult Provincial Industrial Committees, particuularly in the matter of lfocatiơn off induustry.. They shouuld also, where the circumstances of the case require it, consult Industrial Committees in States or State Governments/Durbars. The recommendations should be submitted to Government through the Industrial Adviser.

APPENDIX II

List of Tanneries and Shoe Factories Visited.

Bengal.

1. Bata Shoe Co., Batanagar, 24 Parganas.
2. Bengal Tanning Institute.
3. The National Tannery Co., Ltd.
4. Jubilee Tannery.
5. The Poiner Tannery.
6. The Hindustan Tannery.
7. The National Chamois Works.

Besides :—A Chinese chrome tannery, a bag-tanning establishment and the slaughter house at Tangra, were visited.

Madras.

1. Messrs. Gordon Woodroffe Leather Manufacturing Co.'s Tannery and Chrome Leather Co.'s Tannery at Chromepet.
2. Leather Trades Institute.

Besides :—A few E. I. Kip tanneries in the suburbs of Madras were also visited.

Punjab.

1. Sports Goods Factory of Messrs. Uberoi Ltd., Sialkot.
2. Bata Shoe Co., Ltd., Batapur.
3. The Jullundur Tanning Institute.
4. The Jullundur Mechanical Works.
5. The Jullundur Tannery.
6. The Rahim Tannery.

Besides :—A tanning machinery factory was also visited.

U. P.

1. Government Harness and Saddlery Factory, Cawnpore.
2. Cooper, Allen & Co. Cawnpore.
3. U. P. Tannery, Cawnpore.
4. Eastern Tanneries Ltd. Cawnpore.
5. Cawnpore Tanning Co., Ltd. and its Shoe Factory, Cawnpore.
6. Tanneries and Shoe Factories of the Dayalbagh Industries, Agra.
7. Harijan Shoe Factory, Agra.
8. Cottage Shoe Workers' Busti, Agra.
9. A number of hand-made shoe factories.

Bangalore.

1. Mysore Tanning Co., Ltd.
2. A few other kip and skin tanneries.

Bombay.

1. Modern India Arts Crafts.
2. Leather Goods factory of Messrs. Lalvani Brothers.
3. The Gold Filled Leather Works and the tanneries.
4. The Western India Tanneries Ltd.
5. Bombay Tanning Institutes.
6. One raw hide Picker Works.

APPENDIX III

Distribution of Chamar *and* Mochi *population in different British Indian Provinces and Indian States*

Ajmer-Merwara	17,343
Assam	7,312
Andamans and Nicobars	204
Baluchistan	410
Bengal	5,66,107
Bihar and Orissa	13,16,864
Baroda	54,480
Bombay	7,27,152
C. P. and Berar	10,92,271
Central India	5,26,800
Coorg	242
Cochin	339
Delhi	45,806
Gwalior	4,19,467
Hyderabad	12,81,092
Jammu and Kashmir	1,22,465
Madras	12,35,307
N.-W. F.P.	29,677
Punjab	15,98,288
Rajputana	9,67,519
Sikkim	268
Travancore	6,328
U. P.	63,22,059
Western India States	1,13,187
Total	164,55,487

(Extracted from the Report of the *Census of India*, 1931)

APPENDIX IV

Capacity of the Controlled Tanneries as known to the Directorate of Leather and Foot wear Government of India.

Serial No.	Name of Tannery	Vegetable Tanning Capacity per day in terms of cow hides. (2 Cow Hides = 1 Buff Hide)	Chrome Tanning per day in terms of Cow Hides
1	Messrs. Cooper, Allen & Co., Cawnpore	2,600	2,500
2	,, Cawnpore Tannery Co., Ltd., Cawnpore	1,100	400
3	,, U. P. Tannery Co., Ltd., Cawnpore	950	800
4	,, Indian National Tannery, Cawnpore	800	...
5	,, Eastern Tanneries Ltd., Cawnpore	600	...
	Carried over	6,050	3,700

Serial No.	Name of Tannery	Vegetable Tanning Capacity per day in terms of cow hides. (2 Cow Hides = 1 Buff Hide.)	Chromle Tanning per day in terms of Cow Hides
	Brought forward	6,050	3,700
6	Messrs. Hindustan Tanneries, Ltd., Cawnpore	350	...
7	,, Nordnha Model Tannery, Cawnpore	100	...
8	,, W. B. Shewan & Co., Cawnpore	200	...
9	,, Saghir Tannery Ltd., Cawnpore	200	...
10	,, Dayalbagh Tanneries, Agra	550	300
11	,, Western India Tanneries Ltd., Bombay	400	50
12	,, Gordon Woodroffe Leather Mfg., Co. Ltd., Madras.	430	1,200
13	,, Chrome Leather Co. Ltd., Madras	500	1,100
14	,, National Tannery Co., Ltd., Calcutta	350	150
15	,, N. Mohd. Mian Rowther, Trichinopoly	350	120
16	,, Mysore Tanning Co. Ltd., Bangalore	160	250
17	,, Calcutta Tanneries Ltd., Calcutta	100	200
18	,, M. Nazir Hussain & Co., Madras	100	Not known.
19	,, Ashfaq Tannery, Cawnpore	100	...
20	,, Cawnpore International Tannery Cawnpore.	180	...
21	,, Indian Trading Tannery, Cawnpore	100	...
22	,, Unao Tannery, Unao	160	...
23	,, Imperial Tannery, Unao	40	...
24	,, Pioneer Tannery, Cawnpore	40	...
25	,, Bata Shoe Co. Ltd., Batanagar	930	550
26	,, Bata Shoe Co. Ltd., Batapur	400	120
27	,, Punjab National Tannery, Jullundur	100	...
28	,, Jullundur Tannery, Jullundur	250	120
29	,, Central Tannery, Cawnpore	20	...
30	,, Universal Training Co. Ltd., Cawnpore	180	...
31	,, Madras Industrial Leather Works	180	40
	Carried over	12,520	

Serial No.	Name of Tannery	Vegetable Tanning Capacity per day in terms of cow hides. (2 Cow Hides-1 Buff Hides.)	Chrome Tanning per day in terms of Cow Hides
	Brought forward .	12,520	7,900
32	Messrs. Wazirabad Tannery, Wazirabad . .	150	...
33	,, Punjab Tannery, Wazirabad .	100	...
34	,, Bata Shoe Co. Ltd. Mokamehghat . .	400	...
35	,, Cottage Tanning Institute, Calcutta . .	100	250
36	,, Grant Trunk Tanneries, Cawnpore . .	120	...
37	,, Qureshi Tannery, Unao	28	...
38	,, Asia Tannery, Cawnpore	60	...
39	,, Benares Tannery, Unao	20	...
40	,, Prem Tannery, Cawnpore . . .	74	...
41	,, Asiatic Tannery, Cawnpore . .	16	...
42	,, Oudh Tannery, Unao	40	...
43	,, Deshi Tannery, Cawnpore . . .	60	...
	Total .	13,490	8,150

	Bark Tanned Leather	Chrome Upper Leather
	Lbs.	Sq. ft.
October 40/March 41	1,803,490	...
April 41/December 41	5,024,601	...
January 42/December 42	13,781,010	1,628,630
January 43/December 43	16,547,074	1,836,778
January 44/December 44	13,563,376	28,377
January 45/December 45	6,985,143	2,78,207½

59,968 Chrome Butts were also supplied during 1945 for laces leather.

APPENDIX V

Scheme for a Leather Research Institute.

Research on the Technology of Leather Manufacture involves chemical (both organic and inorganic), physico-chemical, bacteriological, microscopical work, actual making of different varieties of leather, their physical testing, preparation of a number of products used in leather industries and utilization of by-products.

A leather Research Institute to help the development of the Tanning Industry in India and to give it a proper lead should have facilities for all the above mentioned work, it should, therefore, consist of the following :—

1. A Chemical Laboratory.
2. A Bacteriological Laboratory.

3. A Microscopical Laboratory.
4. A Physical Leather Testing Laboratory.
5. A Research Tannery.
6. A Pilot Tanning Extract and Syntan manufacturing Plant.
7. A Pilot Glue Making Plant.
8. A workshop for making a number of preparations like pigment finishes, cellulose lacquers, synthetic bates and many other dressings required in the leather industry. Besides it should train up a few students annually in leather technology to carry out research work.

Estimate of Expenditure involved.

A. Non-recurring.

(1) Land—20 bighas to accommodate the buildings necessary immediately and for future expansion—cost including improvement Rs. 100,000.

(2) Buildings—

Laboratory buildings to accommodate chemical, Bacteriological, Microscopical & Physical Leather Testing Laboratories.

	*300′ × 30′ = 9000 Sq. ft.	
Organic laboratory	50′ × 30′	
Inorganic laboratory	50′ × 30′	
Physico-Chemical laboratory . . .	50′ × 30′	
Bacteriological laboratory . . .	50′ × 30′	
Microscopical laboratory . . .	50′ × 30′	
Physical Leather Testing . . .	50′ × 30′	
	*300′ × 30′	
6 Sitting rooms for Research Officers .	20′ × 15′ × 6 = 1,800 Sq. ft.	
6 Sitting rooms for Assistants . . .	20′ × 15′ × 6 = 1,800	,,
Tannery buildings	600′ × 40′ = 24,000	,,
3 Sitting rooms for Leather Technologists	20′ × 15′ × 3 = 900	,,
3 Sitting rooms for Assistants . . .	20′ × 15′ × 3 = 900	,,
Tanning Extract Factory . . .	100′ × 40′ = 4,000	,,
1 Sitting room for Tanning Extract Expert	20′ × 15′ = 300	,,
Glue Factory	100′ × 40′ = 4,000	,,
1 Sitting room for the Glue Expert . .	20′ × 15′ = 300	,,
Workshop for the making of sundry preparations for the Leather Industry . .	100′ × 40′ = 4,000	,,
Director's room with attached lavatory .	30′ × 20′ 600	,,
General Office	50′ × 20′ = 1,000	,,
Stores	100′ × 20′ = 2,000	,,
Library.	50′ × 20′ = 1,000	,,
Museum	50′ × 20′ = 1,000	,,
Meeting room	50′ × 20′ = 1,000	,,
Visitors' room	20′ × 20′ = 400	,,
Officers' Refreshment room . . .	20′ × 20′ = 400	,,
Assistants' Refreshment room . .	30′ × 20′ = 600	,,
Workmen's Refreshment room . .	50′ × 20′ 1,000	,,
Total	. 60,000 Sq. ft.	

	Rs.	A.	P
Total 60,000 sq. ft. of covered area of pucca buildings with cemented floor etc. @Rs. 15/- per sq. ft. of covered area	9,00,000	0	0
Masonry pits for the Tannery	24,000	0	0
Officer's and Assistant's lavatories	12,000	0	0
Servants' Quarters' compound walls, surface drains, inside roads, latrines and urinals	50,000	0	0
Tube wells and pumps for water supply	50,000	0	0
Total	10,36,000	0	0
(3) Equipment—			
1. Chemical laboratory—Working benches racks, stools, fuming cupboards, chemical balances and other apparatus (required for work in organic, inorganic and physical chemistry—specially Colloids).	60,000	0	0
2. Bacteriological and Microscopical Laboratories—Working benches, racks, balances, autoclaves, incubators, microscopes, pH meters microtomes etc.	40,000	0	
3. Physical Leather Testing Laboratory—Benches, apparatus, for measuring tensile strength, abrasion, water and air permeability, density etc.	40,000	0	0
4. Research Tannery—Tanning Machinery	2,00,000	0	0
5. Pilot Tanning Extraction plant of half a ton capacity consisting of extracting vats, triple effect Kestner's evaporator and a vacuum pan or finisher	60,000	0	0
6. Pilot Glue Extraction plant	50,000	0	0
7. Workshop for making various products for the leather industry—Equipment for making Pigment finishes, *e.g.* Grinding machines, Ball mills and equipment for making many other leather dressings	50,000	0	0
8. Furniture and other Office equipments	75,000	0	0
9. Gas, Electric and water fittings	1,00,000	0	
Total	6,75,000	0	0
Total Non-recurring :—			
(1) Land	1,00,000	0	0
(2) Buildings	10,36,000	0	0
(3) Equipment	6,75,000	0	0
Total Non-recurring	18,11,000	0	0
Student's Hotel	1,00,000	0	0
Total	19,11,000	0	0

(Say 20 lakhs.)

B Recurring :—

Staff	Cost initial year per mensem Rs.
One Director—Rs. 2,000—50—2,500	2,000
*One Chrome tanner specialist in glace kid—Rs. 1,500 (fixed)	1,500
One Chrome tanner specialist in box sides, semichrome and Chrome retanned leather—Rs. 1500 fixed	500
*One Bark tanner specialist in light fancy leather with knowledge of heavy leather—Rs. 1,500 (fixed)	1,500
One Research Chemist (Organic)—Rs. 750—50—1,500	750
One Chemist (Inorganic)—Rs. 750—50—1,500	750
One Chemist (Physical Chemistry)—Rs.—750—50—1,500	750
One Bacteriologist—Rs.750—50—1,500	750
Twelve Research assistants—Rs. 250—25—750	3,000

*Appointments to be made on 3-year renewable contract basis.

Clerical Staff

	Rs.
One Office Superintendent—250—Rs. 15—475—25—500	250
One Accountant—Rs. 150—5/2—200.	150
One Cashier—Rs. 100—5/2—150	100
One Steno-Typist—Rs. 100—5/2—150	100
Two Store Keepers—Rs. 60—4/2—100 each	120
Two Correspondence clerks—Rs. 40—45—5/2—75—3/2—90 each	80
One Typist—Rs. 50—5/2—80.	50
One Librarian—Rs. 40—45—5/2—75—3/2—90.	40
One Duftry—Rs. 25—2/2—30.	25
Ten Orderlies and peons—Rs. 20—1—25 each	200
Sixteen Laboratory boys—Rs. 25—1—40. each	400

Workshop staff—Research Tannery

One Fitter—Rs. 75—5/2—100.	75
One Electrician—Rs. 75—5/2—100	75
One Flesher—Rs. 75—5/2—100	75
Two Unskilled Workmen—Rs. 25—1—40 each	50
Two Drummen—Rs. 25—1—40 each	50
One Machine shaver—Rs. 50—5/2—75	50
One Staker—Rs. 30—2—50	30
One Glazer—Rs. 30—2—50	30
Two Leather Pressman—Rs. 25—1—40 each	50
One Oil man—Rs. 25—1—40.	25
One Hand shaver—Rs. 40—1—50	40
Two Pit workers—Rs. 25—1—40 each	50
	14,615

Tanning Extract Plant—	Rs.	A.	P.
One Tanning Extract Expert—Rs. 250—25—750	250	0	0
One Chargeman—Rs. 75—5/2—100	75	0	0
One Finisher—Rs. 75—5/2—100	75	0	0
Four Unskilled workmen—Rs. 25—1—40 each	100	0	0
One Glue Expert—Rs. 250—25—750	250	0	0
One Mistry—Rs. 75—5/2—100	75	0	0
Four Unskilled workmen—Rs. 25—1—40 each	100	0	0
Total	15,540	0	0
Total Annual initial year (Rs. 15,540 × 12).	1,86,480	0	0
Travelling Allowance	10,000	0	0
Purchase and repair of appliances	10,000	0	0

Contingencies—

	Rs.	A.	P.
Laboratory Chemicals and apparatus	10,000	0	0
Hides and Skins	10,000	0	0
Treatment materials	5,000	0	0
Workshop contingencies	10,000	0	0
Glue Factory contingencies	5,000	0	0
Tanning Extract Factory contingencies	7,000	0	0
Gas, electric and water charges	5,000	0	0
Cart and coolie hire	1,500	0	0
Watch and Ward and Sanitation	3,000	0	0
Telephones	1,000	0	0
Postage stamps	1,500	0	0
Miscellaneous	3,000	0	0
Total	62,000	0	0

Distribution of all allotments over 3 years:—

In the first year of the operation of the scheme land has to be acquired and construction of the buildings commenced. To see that the work as contemplated in the scheme is carried out according to plan, I suggest that the Director and a few office assistants be appointed in the first year of the operation of the scheme. The buildings, it is presumed will not be completed for occupation for 2 years. To accommodate the office of the Director I suggest a suitable building be hired and a few items of furniture be purchased. Services of some of the Research Officers will also be necessary for the preparation of the detailed indents for the laboratory and other equipments and to supervise their fitting in the second year of the operation of the scheme. It is, therefore suggested that some of them be appointed in the 2nd year.

The rest of the staff may be appointed from the 3rd year and the full recurring expenditure for the Institute budgeted during this year.

The distribution of the necessary non-recurring and recurring expenditure provided for in this scheme have accordingly been distributed over 3 years as given below :—

1st Year : Non-recurring.

	Rs.	A.	P.
(1) Land	1,00,000	0	0
(2) Buildings	10,36,000	0	0
Total	11,36,000	0	0

Recurring.

Director—Rs. 2,000×12	24,000	0	0
Office Superintendent—Rs. 250×12	3,000	0	0
Accountant—Rs. 150×12	1,800	0	0
Cashier—Rs. 100×12	1,200	0	0
Steno-Typist—Rs. 100×12	1,200	0	0
Two orderlies—Rs. 20×2×12	480	0	0
Total	31,680	0	
Travelling allowances	5,000	0	

Contingencies—

	Rs.	A.	P.
House rent—500 × 12	6,000	0	0
Electric charges —50 × 12	600	0	0
Furniture and office equipment	5,000	0	0
Telephones	400	0	0
Watch and Ward and Sanitation	800	0	0
Stationery and Forms	100	0	0
Postage stamps	120	0	0
Miscellaneous	350	0	0
Total	50,050	0	0
Grand Total	**12,17,730**	**0**	**0**

2nd year—Non-recurring.

Equipment	6,75,000	0	0

Recurring.

Director—Rs. 2,050 × 12	24,600	0	0
Leather Technologists (3)—Rs. 1,500 × 12 × 3	54,000	0	0
Research Chemist (Organic)—Rs. 750 × 12	9,000	0	0
Research Chemist (inorganic)—Rs. 750 × 12	9,000	0	0
Research Chemist (Physical Chemistry)—Rs. 750 × 12	9,000	0	0
Bacteriologist—Rs. 750 × 12	9,000	0	0
Accountant —Rs. 150 × 12	1,800	0	0
Office Superintendent—Rs. 265 × 12	3,880	0	0
Cashier—Rs. 100 × 12	1,800	0	0
Steno-Typist—Rs. 100 × 12	1,200	0	0
Two orderlies—Rs. 21 × 2 × 12	504	0	0
Six orderlies—Rs. 20 × 6 × 12	1,440	0	0
Travelling allowances	8,000	0	0

Contingencies—

House rent—Rs. 1000 × 12	12,000	0	0
Electric Charge—Rs. 75 × 12	900	0	0
Furniture	2,500	0	0
Telephone charges	400	0	0
Watch and Ward and Sanitation	800	0	0
Stationery and forms	200	0	0
Postage stamps	200	0	0
Miscellaneous	500	0	0
Total	8,24,424	0	0

Third Year.

1. Establishment	1,90,740	0	0
2. Travelling allowances	10,000	0	0
3. Purchase and repair of appliances	10,000	0	0
4. Contingencies	62,000	0	0
Total	2,72,740	0	0
12 Research scholarships @ Rs. 200 per student	28,800	0	0
Total	3,01,540	0	0

Say 3 lakhs.

Non-recurring expenditure	20 lakhs.
Annual recurring from 3rd year	3 lakhs.

APPENDIX VI

List of principal machinery to be imported for a Chrome Leather Tannery with a daily output of 20 hides.

		Present quotation (Approximate) £ s. d.
Fleshing Machine 6′ size—	1	640 0 0
Splitting Machine 6′ size—	1	1,180 0 0
Samamying Machine 6′ size—	2	2,000 0 0
Shaving Machine Single width—	6	2,340 0 0
Shank setting machine, size 14″—	1	240 0 0
Setting out machine, size 7′—	2	2,260 0 0
Staking machine—	4	1,000 0 0
Buffing machine—	4	1,040 0 0
Glazing machine—	8	1,020 0 0
Boarding machine—	1	640 0 0
Spraying machine—	1	150 0 0
Measuring machine—	1	470 0 0
Power Hydraulic Embossing or Ironing Press—	1	2,310 0 0
Total		16,190 0 0
@Rs. 13-1/3 per £	Rs.	2,15,866 10 8
For packing, freight and insurance, etc.	Rs.	42,733 5 4
Total	Rs.	2,58,640 0 0

List of Principal Machinery to be imported for a Sole Leather Tannery with a daily output of 100 hides.

		£ s. d.
Fleshing Machine, size 9′—	1	1,000 0 0
Drum setting and Scouring Machine, size 7′—	1	820 0 0
Setting out Machine, size 7′—	1	1,130 0 0
Rolling Machine—	1	570 0 0
Brushing Machine—	2	200 0 0
Total		3,720 0 0
@Rs. 13-1/3 per £	Rs.	49,600 0 0
For packing, freight and insurance, duty, etc.	Rs.	9,920 0 0
Total	Rs.	59,520 0 0

Principal Machinery required for a Glazed Kid Tannery (Capacity—200 dozens per diem).

		£ s. d.
Unhairing Machine 4'—6'—	1	487 10 0
Fleshing Machine 4'—6'—	1	487 10 0
Turner E Serial tablo setting Machine—	2	1,375 0 0
Single Brush Travelling Band seasoning machine—	1	1,212 10 0
Shaving Machine 12"—	6	1,192 10 0
Bower Glazing Machine—	8	1,000 0 0
Single overshot Buffing Machine—	2	200 0 0
Model B staking Machine—	10	2,400 0 0
Brushing Machine 6'—	1	168 15 0
Top Pan oiling Off Machine 5—	1	375 0 0
Spraying Machine—	1	150 0 0
Single Hydraulic Press—	1	975 0 0
Measuring Machine 6'—	1	381 0 0
Total		10,400 0 0
Plus charges for packing, freight insurance, etc.		2,080 0 0
Total		12,480 0 0
@Rs. 13-1/3 per £	Rs.	1,66,400 0 0

List of Principal Machinery required for an output of 1000 pairs a day.

	No.	Current quotation £ s. d.
Pattern Making.		
Universal Pattern Grading Machine	1	994 0 0
Improved Pattern Shears Model R	1	30 0 0
United Corner Cutting Machine	1	18 0 0
United Pattern Binding Machine	1	30 0 0
1 A Pattern Punching Machine	1	7 0 0
Closing Department.		
No. 5 Marvel Skiving Machine	2	260 0 0
Fortuna Skiving Machine	1	169 0 0
Boothco Beading Machine Model C	1	110 0 0
No. 3 Royal Perforating Machine	1	130 0 0
No. 2 Epoch Eyeletting Machine Motors	2	390 0 0
Motors		70 0 0
Bottom Stock Dept.		
5A—5-ft. Revolution Press	3	1,275 0 0
No. 10 Sole Splitting Machine	2	286 0 0
No. 6 Planet Sole Rounding Machine	3	1,020 0 0
No. 3 Twin Sole moulding Machine	1	525 0 0
No. 4 Apex Channelling Machine	1	128 0 0
No. 3 Channel Opening Machine	1	33 0 0

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GOVERNMNT OF INDIA

DEPARTMENT OF INDUSTRIES & SUPPLIES

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REPORT

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PART I

PLASTICS INDUSTRY

Growth of the Plastics Industry.

Few materials used or made by man have aroused so much interest and speculation regarding their future uses, as the synthetically produced or naturally occuring resinous substances, capable of being shaped into any form by the application of heat and pressure, now familiarly known as ' plastics.' So rapid has been the development in this industry that today, plastics in one form or another, have entered into every walk of life. It is interesting to note that a few years ago, the Chemical Division of the Department of Commerce in America and the staff of the famous magazine—*The Modern Plastics*, jointly sponsored a plastics exhibition known as " Plasti city." Everything, from a household appliance to a defence weapon, was represented at this exhibition. Textiles made from plastics, interior designs and decorations for architectural purposes, plastic applications in the aeronautic and automobile industries as well as a large variety of sporting goods and accessories, raw materials, moulding powders, rods, tubes, sheets and preforms were the special features of the show which established beyond doubt the great future for this new and interesting industry. Similarly a famous research organization in the United States of America conducted a poll to determine what industries will, in the next decade, make the largest contribution towards the progress, employment and general welfare of the Americans. It was a surprise that plastics came third on the list, the first two being aviation and electronics.

2. Just as the dye-stuffs industry deals with naturally-occurring dyes and synthetic dyes, so can the plastics industry be conveniently considered to be based on the following types of materials :—

(*i*) Synthetic resins such as phenol-formaldehyde, amino resins, alkyd, nylon, polyethylene, silicone etc.

(*ii*) Naturally occurring resins such as lac and rosin and resins derived from casein, bhilawan shell liquid, cashew nut shell liquid etc.

Although the synthetic resins contribute at present a bulk of the world's production of plastics, as a greater uniformity of product is guaranteed in the synthetic field, more attention is likely to be paid in future to naturally occurring resins owing to the varying types of uses to which these can be put when modified by suitable chemical and physical processes.

3. The oldest synthetic plastic is probably celluloid, which is nitrocellulose plasticised with camphor and was discovered in 1868. The next synthetics to appear were the casein plastics (1890). In 1909 Baekeland announced a new type of synthetic material known after his name as bakelite. This material which is prepared from phenol and formaldehyde is decidedly one of the finest synthetic plastics perfected up to date, and finds innumerable uses. So rapid has been the development in the field that today a wide range of synthetic plastics in various colours suitable for different uses is available at fairly competitive prices. The progress of the synthetic plastics industry during the last seventy years is detailed in Appendix I.

World Plastics Production.

4. The present world production of plastics is estimated at about 2,000 million lbs. annually. The United States of America lead all other contries in total production, varieties of applications and types of plastics produced. The U.S.A. production in 1944 was estimated at 700 millios lbs. as compared to 213 million lbs. in 1939 (App. II). The production figures in terms of different important types of synthetic plastics produced in the U.S.A. during the years 1941-45 are given in App. III. In 1944 there were about 1,232 companies producing plastics goods in the U.S.A. The number of machines in operation during this period was 13,680 (App. IV and V).

5. At the beginning of World War II, the main producers of plastics goods were :—

1. United States of America.
2. Germany.
3. Great Britain.
4. Japan.
5. France.
6. Soviet Russia.

Although latest production figures from these countries except the United States of America are not available, it is reported that very large quantities of plastics were produced and used for domestic requirements and defence purposes. It is understood that in Germany plastics products were used in the manufacture of ordnance equipment and also in ship building where advantage was taken of the lower weight and the higher resistance of plastics to corrosion in comparison with metals and lower inflammability in comparison with wood. It is difficult to enumerate all the uses, plastics have been put to, during this war. It is, however, certain that during the post-war period plastics in one form or other will find use in the every day life of the people.

Case for the Establishment of the Industry in India.

6. Before the beginning of World War II, the plastics industry hardly existed in India. There were about a dozen moulding concerns where plastic articles such as ash-trays, cups, saucers, soap boxes, combs etc. were moulded out of imported moulding powders. It is estimated that about 600 tons of moulding powders were imported annually in the pre-war period. During the war one or two Indian concerns started, on a small scale, the manufacture of moulding powders, but their production is not believed to have exceeded 60 tons per annum.

7. As separate statistics of plastics goods and moulding powders are not maintained by the Customs authorities, it has not been possible to correctly gauge the pre-war consumption of plastics in India. This Panel strongly recommends that in future the Government should separately specify the imports of different plastics good and moulding powders in the Customs returns.

8. The per capita consumption of plastics in different countries during 1937 was estimated as follows :—

Germany	1·5	lbs.
U. S. A.	1·45	,,
England	1·1	,,
India	0·003	,,

In 1945, the per capita consumption in the U. S. A. has been estimated at about 6 lbs.

9. With the rise in the standard of living and the increase in the purchasing power of the people, the demand for plastics goods is expected to increase rapidly in the post-war period. India possesses the resources

necessary for the production of raw materials required for the synthetic plastics industry and has in addition an abundance of naturally occurring resins and resin forming materials. With the development of chemical industry in India and with the aid of extensive research and proper standardization of products, it ought to be possible, therefore, to establish a flourishing plastics industry in this country.

10. Since the manufacture of moulding powders is closely linked up with the development of the chemical industry, the Panel feels that the plastics industry should be developed in this country on the following lines :—

(*a*) Immediate expansion of the moulding industry by using imported moulding powders.

(*b*) Production of moulding powders, in the country, using imported materials.

(*c*) Utilisation of synthetic and naturally occurring resins for impregnating cloth and paper and for making plywood, synthetic boards etc.

(*d*) Production of articles fabricated from plastics sheets, tubes and rods, such as fountain pens, costume jewellery, toys etc.

(*e*) Manufacture of paints, varnishes and enamels from imported and naturally occurring resins.

(*f*) Intensification of planned and co-ordinated research in the development of naturally occurring resins.

(*g*) Establishment of the chemical industry for the manufacture of synthetic moulding powders.

Present Position of the Plastics Moulding Industry in India.

11. The moulding of plastic articles has been successfully undertaken in India during the last few years. Appendix VI attached to this report gives a list of firms where moulding is carried out, together with details of press capacity available with these firms. There are at present about 75 presses in India engaged in compression moulding which can handle a total tonnage of approximately 1,000 tons of moulding powders. The majority of these presses are manually operated and are out of date. The maximum rating (total pressure) of any single press is only 100 tons which is much smaller than those commonly used in moulding plants in foreign countries. There are also about six injection moulding presses of small capacity moulding thermoplastic articles.

12. Appendix VII gives a list of dies available in India, for moulding plastic articles. It will be seen from this list that there are in all about 220 dies in the country. The only existing dies for injection moulding are those for combs and bottle caps.

Future Expansion of the Moulding Industry :—

13. The Panel is of the opinion that an immediate start should be made by expanding the moulding industry which could use imported moulding powders in addition to what may be locally available. It is felt that the present production will fall short of the anticipated post-war demand, in view of the numerous articles in which plastics will find use. The Panel recommends that the Indian moulding industry should be expanded to use about 3,000 tons of moulding powders per annum during the next five-year period. A list of the different articles

proposed to be manufactured along with approximate quantities of each item to be produced annually is given in Appendix VIII.

14. The Panel is of the opinion that most modern types of automatic presses with capacities up to 300 tons and injection moulding machines with capacities up to 12 ozs. should be imported. The existing restrictions on exchange should be relaxed so that the choice of the Indian buyers is not restricted to the types of machinery available in sterling areas only. The Panel further recommends that the Government should provide all facilities to prospective buyers of plastics machinery for early procurement of capital goods required by the industry.

15. The Panel very strongly feels that along with the import of presses, up-to-date die making equipment should also be imported. The Panel recommends that in the beginning two central die designing and making establishments should be set up preferably at Bombay and Calcutta. The Government should give all assistance for the procurement of capital goods for this industry and also arrange to get two efficient die designers from abroad preferably from the United States of America, for these two establishments. The Government should also send abroad two Indian technicians every year for advanced training in die designing for the next five years.

19. Moulding powders are classified into two main types :—

(*i*) Thermo-setting.
(*ii*) Thermo-plastic.

The thermo-setting types when subjected to a sufficiently high temperature and pressure produce moulded articles which are not softened by subsequent application of heat and thus have good thermal stability. Phenol-formaldehyde and urea-formaldehyde are typical examples of this class.

The thermo-plastic types are characterised by their ability to shape while hot, and permit of a reversal of the process. In view of this property articles made from thermo-plastic moulding powders are generally subject to heat distortion, Cellulose acetate and polystyrene are typical examples of thermo-plastic materials. The Indian consumption of moulding powders in the past has been about 5 per cent thermo-setting types and 15 per cent. the rmo-plastic types. The Panel however, feels that in future the proportion will change to 70 per cent thermo-setting and 30 per cent thermo-plastic. In view of the increasing uses which thermo-plastic materials are finding in industrially advanced countries, this proportion may, in the opinion of this Panel, even become 50 per cent. in the post-war period.

17. The Panel is of the opinion that a moulding plant utilising 100 tons of moulding powders per year is a minimum economic unit under Indian conditions. It is, however, felt that the moulding industry can, with adequate central direction and co-ordination, also be worked profitably on a small scale as an individual enterprise.

18. Regarding location of moulding factories, the Panel is of the opinion that moulding plants may be located in any part of the country preferably near trade centres.

19. Calculating on the basis of prevailing quotations in the United States of America (supplied by Panel members), the moulding industry including the die-making plants will require capital goods worth about Rs. 1·1 crores during the next five-year period.

20. The Panel is of the opinion that private enterprise can cope with the development of plastics moulding and die-making industries

without foreign co-operation in respect of capital or management. In case private capital is not forthcoming for the installation of die-making plants, the Government should subsidise the undertaking in view of its basic need for the development of the plastics industry.

21. During the war anti-gas cloth was being made in the country with methods developed in India and a number of textile mills and other firms set up impregnating and drying machinery. This experience could be profitably utilised in the manufacture of book binders" cloth, oil-cloth, oil silk etc. Modern machinery could be imported if and when necessary to utilise naturally occurring and imported resins for these purposes. As regards use of resins in the manufacture of paints, varnishes etc., certain products such as bhilawan paints and varnishes, and lac preparations are already being commercially exploited.

Future Development of the Moulding Powder Industry in India.

22. The Panel feels that the production of the following synthetic moulding powders should be started in the country as soon as the basic chemicals required for their manufacture are available at economic prices and the demand for moulding powders is sufficiently large to justify the erection of an economic unit for each type.

(*i*) Phenol- formaldehyde
(*ii*) Urea-formaldehyde
(*iii*) Cellulose acetate
(*iv*) Cellulose nitrate.

23. For a long range industrial development plan, the production of the following synthetic plastics resins should be undertaken in the country—

(*a*) Melamine, (*b*) Furfural-phenol, (*c*) Nylon, (*d*) Polyethylene, (*e*) Alkyd, (*f*) Vinyl, (*g*) Acrylic, (*h*) Silicone, (*i*) Polystyrene.

Phenol-formaldehyde Resins.

24. Phenol-formaldehyde resins popularly known under the trade name of bakelite constitute one of the most important and extensively used synthetic plastics. They are thermo-setting and have been put to a large number of uses. Appendix IX gives a list of some of the items in which they can be suitably used. They are manufactured from phenol or cresols and formaldehyde. In the opinion of the Panel the first step towards the development of the moulding powder industry in India should be the manufacture of phenol and formaldehyde required for this type of plastics. During the next five-year period an annual production target of 1500 tons of phenol-formaldehyde and 500 tons of urea-formaldehyde resins is recommended.

Phenol and Cresols.

25. Phenol and cresols are coal-tar distillation products but phenol is also prepared from benzene by the benzene sulphonation and the chloro-benzene synthetic processes. Benzene is mainly obtained during the carbonisation of coal. A large quantity of benzene is produced in the country and it is believed that about 1·35 million gallons will be available annually in the post war period. The Panel is of the opinion that two plants each manufacturing 10 tons of phenol per day from benzene (one by the sulphonation process and the other by the chloro-benzene method) should be established in the country in the post-war period. These should be located in the vicinity of coal carbonisation centres or other suitable places. These plants will be able to meet the requirements of

the plastics industry and other important industries in which phenol finds use. Detailed information about the processes is available from consulting chemical engineers in U.K. and U.S.A.

Formaldehyde.

26. Formaldehyde in the form of 40 per cent solution is the principal aldehyde used for the manufacture of phenolic resins. It is also used as a disinfectant, preservative and in dyeing processes etc. Formaldehyde has been manufactured on a small scale in this country at Bhadravati (Mysore) from methyl-alcohol which in turn is obtained by the destructive distillation of wood. A big plant for the manufacture of synthetic methyl alcohol is being planned at Sindri (Bihar). It is recommended that arrangements should be made for the production of formaldehyde as soon as cheap methyl alcohol is available in sufficient quantities.

Urea-formaldehyde Resins.

27. Urea formaldehyde resins form yet another important and promising set of synthetic plastics. Urea and formaldehyde in combination with lac have yielded a good quality moulding powder which is manufactured in India in small quantities under the name of " laclite " moulding composition ; and was extensively used during World War II when foreign supplies of moulding powders were severely restricted. The urea-formaldehyde resins are suitable for use in the manufacture of a large number of articles, some of which are given in Appendix X.

Urea.

28. Urea is the main raw material for the manufacture of this class of resins. It is manufactured by the interaction of ammonia and carbon dioxide. It is understood that there are plans to install a urea plant near the Government Fertiliser Factory at Sindhri (Bihar) capable of producing 10,000 tons per annum. This plant when established will be able to divert a portion of its production for use in the plastics industry.

Cellulose Acetate and Cellulose Nitrate.

29. Cellulose nitrate is employed in the manufacture of celluloid which is one of the oldest plastics known. Both cellulose acetate and nitrate are thermoplastic materials and find extensive use in the manufacture of numerous utility articles (App. XI).

Besides these uses, they form important ingredients in the manufacture of artificial silk, raw films, explosives, lacquers etc. The Panel recommends that during the first five-year period one plant manufacturing 2000 tons of cellulose nitrate and 1000 tons of cellulose acetate annually should be set up in the country. The requirements of the rayon and other industries have not been taken into consideration in this estimate. The main raw materials required for these are pure cellulose (chemical cotton), acetic acid, acetic anhydride, nitric acid and sulphuric acid.

Cellulose.

30. Cellulose (chemical cotton) is the chief raw material required for the production of cellulose acetate and nitrate. Although India abounds in many cellulose-bearing materials, chemical cotton produced from cotton linters is the most suitable raw material for the manufacture of acetate or nitrate. The actual production of linters in India before the war was estimated at about 15000 bales of 400 lbs. each. This production was, however, only a small fraction of the capacity as

large quantities of cotton seeds were not delinted. It is difficult to make an estimate of the total quantities of linters in India, but even if a fairly large proportion of the linter bearing seeds of the Indian varieties are delinted about 75,000 bales representing about 30 million lbs. of linters would be available annually. The Panel very strongly recommends that every assistance should be given by the Government for the installation of delinting machines in ginning factories and cotton seed oil mills.

Acetic Acid and Acetic Anhydride.

31. Acetic acid is being produced in India in small quantities (about 100 tons per annum) from calcium acetate which is obtained from the wood distillation plant of the Mysore Iron and Steel Works at Bhadravati. The Hyderabad Chemical and Fertiliser Co. propose to set up a plant producing 150 tons of acetic acid per year. The Panel recommends alternative processes of producing acetic acid from (*a*) acetylene and (*b*) alcohol.

It is understood that some Indian industrialists are exploring the possibilities of manufacturing acetic acid from alcohol. The economic aspects of this method need careful investigation. With the development of the hydro-electric projects in the post-war period, the acetylene method could also be adopted with advantage.

Nitric Acid and Sulphuric Acid.

32. The economic production of cellulose nitrate in India will largely depend upon the availability of cheap nitric and sulphuric acids.

Melamine.

33. Melamine is manufactured commercially from calcium cyanamide. Melamine-formaldehyde resins are thermo-setting and have been put to a number of uses. They have superior heat and water resistance.

Furfural.

34. Furfural is an aldehyde obtained from the distillation of corn cobs, rice husks, bagasse etc In combination with phenol it yields a good resin. It is understood some industrialists are planning to instal furfural plants in India.

Nylon.

35. Nylon is a synthetic resin belonging to the group of polyamides and has gained immense popularity specially in the manufacture of fibres and filaments. The nylon of commerce is a condensation product of adipic acid and hexamethylene diamine. Adipic acid is obtained by the oxidation of cyclohexanol, which in turn is obtained from phenol. The diamine is synthesised from adipic acid and ammonia. Thus the only important raw material is phenol which is produced from benzene by the benzene-sulphonic acid or the chloro-benzene methods.

Polyethylene Resins.

36. Polyethylene resins are a new group of thermo plastic materials recently developed. The basic raw material is ethylene which is obtained in large quantities by the cracking of petroleum oils and by hyderation of alcohal. The resin is manufactured by subjecting purified ethylene to extremely high pressures. Variations in the technique employed result in the production of various grades of resins having different average molecular weights. The paraffinic structure gives these resins very high electrical resistance, remarkable chemical

inactivity, and high water resistance. Polyethylene resins found their first use in the insulation of cables for use in telephones, telegraphs, sub-marine cables and television. They played an important role in the successful development of the famous radio location device, "Radar," on account of their insulating properties in high frequen y cables.

Alkyd Resins.

37. When a polyhydric alcohol is esterified with a polybasic acid a complex resinous ester of high molecular weight results. These resins are known as alkyd resins. The basic raw materials required are glycerine pentacrythritol, phthalic and malic anhydrides. These resins find application where high resistance to severe atmospheric and weather conditions are required. Their main use is in the varnish and protective coating industries.

Vinyl Resins.

38. Compounds containing the vinyl linkage *i.e.*, $CH_2=CHX$ where X is a strongly negative group, polymerise to give hard, thermoplastic resinous materials, known as vinyl resins. One of the first uses of vinyl resins was in the manufacture of records for the transcription of sound. Vinyl resins are used in the lining of food and beer cans, and for the impregnation of paper used in wrapping foods. Recently they have been used in the manufacture of safety glass and synthetic fibre known as vinyon.

Acrylic Resins.

39. Acrylic resins are manufactured from acrylic esters by thermal polymerisation in the presence of benzoyl peroxide or a similar catalyst. Those resins are outstanding in their light weight, transparency, water and chemical resistance, electrical properties, heat and light stability, toughness and high softening point. Sheets of these resins are used for windows and cockpit enclosures of aeroplanes. In the textile field, acqueous dispersions of acrylic resins are used as finishing materials. Various ornamental and decorative articles are made by injection moulding or casting. A recent development is moulding reflectors for highway warning signals.

Silicone Resins.

40. These novel and fascinating resins have been developed by Dow Corning Corporation and General Electric Company in America and are polymerised organic compounds of silicon. Silicon tetrachloride is first converted into organo-silicon chlorides which are then hydrolysed to produce the compounds known as silanols. The silanols undergo polymerisation to give siloxanes which are the structural units of silicone resins. Among the many valuable qualities of these new resins, the most striking are high heat resistance, chemical inertness and excellent dielectric properties.

Polystyrene.

41. Polystyrene was commercially introduced as a plastics material for injection moulding in 1938-39. Since then it has gained immense popularity and has found many uses. The U.S.A. production for 1945 was estimated at about 15 million lbs. The special properties of polystyrene are excellent resistance to corrosive chemicals, negligible water absorption, good electrical properties, light weight; stability at low temperatures etc.

NATURALLY OCCURRING RESINS

Lac Resins.

42. Lac is one of the oldest and most important natural resins, its chief use being in the manufacture of gramophone records for which purpose it is still better than any other synthetic plastic substitute. India produces over 90 per cent of the total world output. Average annual production (1934-39) was 47,750 tons, of which more than 90 per cent was exported in various forms. The used of lac as a plastic material is well known. The articles made from unmodified lac in conjunction with suitable fillers have however certain dra \ backs, specially their poor shock and heat resistance. With the advent of synthetic resins particularly of the bakelite type, unmodified lac has lost some of its importance. In order to recover the lost ground experiments were conducted to chemically modify lac with a view to eliminate its drawbacks and bring out its latent thermosetting and other desirable properties. Lac, when treated with urea and formalin and mixed with suitable fillers, gives rise to a type of moulding composition which approaches bakelite in many of its properties and can be worked under the compression moulding technique. The lac moulding powders in their present state of development are quite suitable for making electrical goods such as switches, ceiling roses etc., and for articles which do not require bright colours or call for alkali and high thermal resistance. It is understood that some firms are already manufacturing these moulding compositions although their production is not much. There are good prospects of developing lac plastics in India and extensive research work should be carried out to utilise other products such as cashew nut shell liquid etc. in conjunction with lac. Lac is also used for the manufacture of :—

(1) Varnishes, for electrical, radio and other industrial applications.

(2) Adhesives for micanite products, abrasive wheels etc.

(3) Varnishes for anti-gas fabrics, oil cloth, water-proof binding cloth etc.

(4) Laminated paper products for insulation purposes.

(5) Laminated jute products for panels, tea chests, containers etc.

(6) Sealing wax.

(7) Lac bangles.

(8) Water proof printing inks.

Lignin Resins.

43. The use of lignin as a plastic material has attracted attention recently. It is obtained as a by-product in the manufacture of wood pulp. The development of lignin plastics will have to await the establishment of the wood pulp industry in the country.

Bhilawan Reins.

44. Bhilawan (Semecarpus Anacardium Linn., marking nut) is included among the minor forest products and is collected along with myrobalan in the Central and Southern Indian forests. The resin obtained from bhilawan has been successfully used in the manufacture of air-drying varnishes, stoving enamels and moulding powders. The process of manufacture involves the heat treatment of the bhilawan shell liquid in the presence of certain catalysts. Various grades of enamels have been

produced by modifying the resin with vegetable oils, shellac, casein etc. The special qualities of bhilawan enamels are hardness, elasticity, gloss, resistance to high temperature and chemicals. Modified bhilawan moulding compositions have been moulded into various attractive articles. No separate organization exists for the collection of bhilawan nuts and therefore statistics regarding their distribution and extent of availability could not be gathered from the Forest Department authorities. In view of the rapidly growing importance of this raw material for the plasitcs industry, the Panel recommends that the Government should expeditiously arrange for the carrying out of a survey regarding its availability in different parts of the country.

Cashew Nut Shell Liquid.

45. Cahew nut shell liquid is an important bye-product of the cashew nut roasting industry of Southern India which works up to about 70,000 tons of cashew nuts per year. During the last decade a number of plastic compositions have been worked out from cashew shell liquid in the U. S. A. The demand for this product enormously increased during the last war for the manufacture of a variety of articles such as varnishes, insulating coatings, brake-linings etc. During the year 1942, the total production of cashew shell liquid in India was about 3,000 tons nearly the whole of which was exported to the U. S. A. With the object of utilising the cashew shell liquid for the benefit of the Indian industry investigations were taken up by the Council of Scientific and Industrial Research. As a result of this work a process for the conversion of cashew shell liquid in combination with varying proportions of bhilawan shell liquid into a semi solid resin has been patented. The resins obtained by this process have also been utilised for the production of enamels, varnishes, water-proofing compositions and moulding powders. Interesting results have also been obtained by the Indian Lac Research Institute, Ranchi, on the industrial utilisation of cashew shell liquid. The Panel recommends that there should be further intensification and co-ordination of research on the industrial utilisation of cashew shell liquid.

46. The Panel feels that although synthetic resins are superior to natural resins in certain qualities, the latter will obviously play an important role in the development of the plastics industry in this country. Chemically modified natural resin plastics already occupy a recognized position in the Indian plastics trade. Intensive researches in this field are bound to further extend the applications of natural resins.

47. In addition to synthetic or natural resins, moulding powders also require the following ingredients in their manufacture :—

(*a*) fillers
(*b*) plasticisers
(*c*) lubricants

Fillers.

48. Thermo-setting resins are not suitable for direct moulding and generally require the addition of considerable proportions of filling materials before they can be used in moulding compositions. Mouldability, finish, strength, toughness, resistance to heat, moisture and chemicals and electrical insulation are greatly determined by the nature of the fillers. They also reduce the cost of the moulded article by replacing the costly resin in the moulding composition. Fillers are usually obtained from naturally occurring substances or from industrial wastes

by simple physical and chemical means Some of the important fillers used by the plastics industry are wood flour, nut shells, cotton linters or wastes, graphite or carbon black, asbestos, mica, whiting etc.

Wood Flour.

49. Wood flour is the most important and widely used fillers particularly in phenolic resins. At present there is no plant in India manufacturing wood flour and the suitability of using various Indian woods for this purpose needs careful investigation. In foreign countries the wood flour industry is properly organized, and special methods for pulverising and refining are adopted. The Panel is of the opinion that the wood flour industry should be established in the country. More extensive research should be carried out to select the proper variety of wood and to standardise the process of manufacture of wood flour. A production target of 1,500 tons per year is recommended during the next five-year period.

50. Besides wood flour, India possesses abundant supplies of other cellulose fillers such as cotton linters, cotton waste, jute waste, etc. Mica and asbestos are also available in the country and can be suitably used as fillers by the plastics industry and their use for this purpose should be extended.

Plasticisers.

51. Some resins are not capable of being moulded without the incorporation of certain materials which give them the requisite plasticity and are known as plasticisers. They are classified into two main groups :—

(1) The solvent type plasticisers *e.g.*, methyl phthalyl ethyl glycolate used for cellulose acetate.

(2) The non solvent type plasticisers or gelatinisers. These are not true solvents but show partial solubility of the resin *e. g.*, tricresyl phosphate.

The suitability of different plasticisers varies with different resins and a proper choice can only be made after experimentation. The Panel feels that in view of the fact that only small quantities of plasticisers will be required by the plastics industry, these should be imported from abroad in the initial stages. Extensive research should however be continued to develop their manufacture in the country.

Lubricants.

52. Lubricants are added to plastic compositions to prevent moulded pieces from sticking to the mould. The proper lubricant for use with any one plastic is best determined by trial. They may either be incorporated in the plastic mix or applied to the mould. Materials generally used are stearic acid and some of its metalic salts like zinc stearate, aluminium stearate and its esters like ethyl, butyl or amyl stearates. Most of these can be made available in the country.

Rubber.

53. Rubber itself, when compounded with sulphur behaves like a thermo-setting plastic material. Two other modifications of rubber are in commercial use as plastics—chlorinated rubber and isomerised rubber.

Chlorinated rubber is made by chlorination of rubber in solution in carbon tetrachloride and in the presence of a catalyst such as iodine. Rubber derivatives have been successfully used in (*a*) floor paints and

enamels, (*b*) protective coatings of articles which come in contact with chemicals or corrosive gases, (*c*) painting over fresh concrete. Isomerised rubber is made by mixing rubber with a metal chloride such as stannic or antimony chloride. It is used principally in the form of thin transparent sheets for rain coats, umbrellas and household novelties.

Hard rubber has also been used for the manufacture of a number of utility articles specially where insulating properties are desired. Recently waste rubber has been reclaimed in India by treatment with bhilawan or cashew shell liquids. A process has been developed, by the Council of Scientific and Industrial Research, for the production of high quality hard rubber goods from scrap rubber.

Research.

54. The rapid development of industries in the Western countries is largely the result of close co-operation which prevails between science, technology and industry. The Indian industry has not enlisted the aid of scientific research for improving its processes and finished products. As a result Indian industry has depended largely upon imported machinery and on processes made available by foreign manufacturers. Research assumes special significance in the case of the plastics industry on account of the great rapidity with which this industry is undergoing improvements in industrially advanced countries. Huge sums of money are being spent there for this purpose. The Panel feels that the plastics industry should be developed in India with the aid of extensive research both on synthetic and naturally occurring materials. It is understood that the proposed National Chemical Laboratories of the Council of Scientific and Industrial Research are going to have a separate Division for research on high polymers. The Panel is of the opinion that this Division which would be fully equipped with all the necessary apparatus and machinery would be in a position to tackle problems relating to the synthetic plastics industry. The two Cellulose Research Institutes, which it is learnt have been recommended by the Rayon Panel, would in able to deal with research problems of the plastics industry using cellulosic raw materials.

PART II

RAW FILM MANUFACTURE

55. Raw film manufacture is a highly technical and specialized industry. Processes of manufacture adopted in foreign countries are strongly guarded secrets covered by innumerable patents. The entire industry all over the world is monopolised by five leading concerns. Before the war, Germany and the United States of America were the leading manufacturers of raw films. The only important concerns in the field are Kodak, Ansco, Du Pont, Agfa and Gaevert.

56. The raw film industry covers the production of the following :—

(*i*) motion picture films ;

(*ii*) photographic films ;

(*iii*) graphic art films ;

(*iv*) x-ray films.

Case for the Establishment of the Industry in India.

57. The motion picture production industry occupies one of the foremost places amongst the various industries in the country. It is reported that there are about 42 studios in the country and more than 350 units are engaged in film production. It is estimated that nearly Rs. 12 crores are

invested in the production, distribution and exhibition branches of the industry, which directly or indirectly employs about 30,000 persons. About Rs. 9 crores are spent annually in the production line, out of which about Rs. 35 lakhs is the estimated cost of imported raw films (Appendix XII).

58. World War II brought about an acute shortage of raw film all over the world. The imports of photographic and x-ray films into India had practically ceased, while whatever motion picture film was imported, was hardly sufficient to meet the demand of the motion picture industry. Films have a recognized place in the educational, social and cultural development of a nation. With the increase in the purchasing power of the people, spread of education and social and political awakening, the film industry is bound to flourish in the future. In addition appreciable quantities of raw films will be required for scientific and medical work. It is, therefore, essential that the manufacture of raw films in the country should receive a high priority in our post-war industrial development plans.

Post war Target.

59. The pre-war imports of motion-picture raw film were about 80 million feet per year. With the rapid growth of the Indian film industry it is expected that during the next five years, the consumption of motion picture raw film will rise to about 200 million feet or 25 million square feet. Besides this, about 25. million square feet of photographic, x-ray, graphic art films etc. will be required. The total annual consumption at the end of the next five years can therefore be estimated at 50 million square feet. In course of time it is expected that foreign film companies will import duplicate negatives and get the positive copies made in India, provided the proper quality of film is available in the country. The Panel therefore recommends that steps should be taken to set up one factory capable of manufacturing 50 million square feet of raw film of all types per annum.

Foreign Co-operation.

60. As stated before, the industry is of a highly technical and specialized nature and the processes of manufacture employed are closely guarded secrets of a few foreign manufacturers. Consequently co-operation with some reputed foreign manufacturer is considered essential for the establishment of this industry in India. The Panel is therefore of the opinion that the Government should take the initiative in this direction and arrange with some foreign firm in the U. S. A., Germany or Belgium for assistance in establishing the industry in India. For this purpose it may be necessary to sponsor a joint venture with foreign manufacturers in order to get the benefit of their patents and technical personnel for setting up the factory and running it till Indian technicians are fully trained to run it successfully. Another method which may be explored is that the foreign manufacturers may be given a royalty on production for their patents and technical advice.

Raw Materials and Chemicals.

61. The cellulose derivatives are the main raw materials used for film manufacture. Of the cellulose derivates used, nitro-cellulose still constitutes the largest proportion, finding a place chiefly in motion picture film and roll or pack film. Although the inflammability of the nitro-cellulose film presents some hazards if improperly handled, it finds general use in commercial motion picture film of 35 mm. width because of its resistance to curling under high humidities and its toughness which enables users to run the reels without breaking through the drive notches. During recent years organic esters of cellulose such as cellulose acetate have also been used

with advantage. The long life of acetate films on storage and their non-inflammability have led to its widespread adoption for the photographic duplication of commercial and Government records, preservation of facsimiles of old documents etc., Where larger films, which do not require projection are needed and storage of negative is essential (*e.g.*, x-ray), cellulose acetate films are generally used. There are also other cellulose mixed esters, which are used for special types of films. It is estimated that in the U.S.A., about 15 million lbs, of all the different varieties of cellulose esters are used annually for the manufacture of raw films. In addition to cellulose esters, the manufacture of raw film requires more then 50 other inorganic and organic chemicals, although the quantities involved are comparatively small (Appendix XIII).

Stages of Development.

62. The Panel recommends that the development of the raw film industry should be in the following stages :—

(*a*) coating and processing of imported film base ;

(*b*) manufacture of film base in the country using imported chemicals ;

(*c*) manufacture of raw materials and chemicals required for the production of film base.

Since chemicals of special degree of purity are required for photo-sensitive work it will not be advisable to delay the establishment of the industry till such time as they can be manufactured in the country. It is more advantageous to import the film base in the early stages and to carry out only the coating, processing and finishing operations in the country with imported chemicals.

Protection.

63. Regarding protection for the industry, the Panel recommends that the Governnent should give adequate protection to the industry in the form of subsidy, bounties or by any other means which will not adversely affect the motion picture producing industry. In view of the fact that the industry will use imported chemicals in the initial stages the Panel feels that the import of chemicals used specially for raw film manufacture, should be allowed duty free. The draw-back rebate system is recommended as suitable for this purpose. The Panel further recommends that concessional railway rates should be fixed for the movement of raw materials required by this industry and its finished products.

Capital Goods.

64. According to figures supplied by one of us, Dr. M. S. Patel who had been in the United States of America recently, an up-to-date plant manufacturing about 50 million square feet of raw film of all varieties will cost about Rs. 3 crores.

Location of Industry.

65. The selection of a proper site for this industry is of great importance and is chiefly influenced by the following factors :—

(*i*) Even and moderate climate ;

(*ii*) Minimum dust in the atmosphere ;

(*iii*) Abundant supply of photographically inactive water ;

(*iv*) Availability of raw materials,

The Panel is of the opinion that a site near Poona is likely to be suitable for setting up a raw film factory. The Panel however feels that the actual selection of site should be settled in consultation with experts who may be employed for the purpose of developing this industry in India.

Technical Training.

66. There is no denying the fact, that there is at present an acute dearth of technical personnel in India It is more so in the case of this industry, where not a single Indian can claim to be an expert. When plans for the establishment of this industry are afoot, it is essential that due attention should be paid to the training of technical personnel.

The Panel recommends that the Government should, during the next five year period, arrange to send at least 20 properly qualified young Indians abroad for specialized training in raw film manufacture. They should be trained for a period of two years in factories manufacturing raw films.

SUMMARY OF RECOMMENDATIONS

The Panel is of the opinion that the consumption of plastics goods in India is bound to increase rapidly in the post-war period and the industry should be developed in the country on the following lines.

(*a*) Immediate expansion of the moulding industry by using imported moulding powders.

(*b*) Production of moulding powders in the country using imported materials.

(*c*) Utilization of synthetic and naturally occurring resins for impregnating cloth and paper and for making plywood, synthetic boards etc.

(*d*) Production of articles fabricated from plastics sheets, tubes and rods such as fountain pens, costume jewellery, toys etc.

(*e*) Manufacture of paints, varnishes and enamels from imported and naturally occurring resins.

(*f*) Intensification of planned and co-ordinated research in the development of naturally occurring resins.

(*g*) Establishment of the chemical industry for the manufacture of synthetic moulding powders.

II. An immediate start should be made by expanding the moulding industry which could use imported moulding powders in addition to what may be locally available. The Panel recommends that the Indian moulding industry should be expanded to use about 3,000 tons of moulding powders per annum during the next five-year period.

III. A moulding plant utilising 100 tons of moulding powders per annum is considered a minimum economic unit under Indian conditions. Moulding plants may be located in any part of the country preferably near trade centres.

IV. The Panel recommends that the production of the following synthetic moulding powders should be started in the country as soon as the basic chemicals required for their manufacture are available at economic rates and the demand for moulding powders is sufficiently large to justify the erection of an economic unit for each type.

(*a*) Phenol-formaldehyde.
(*b*) Urea-formaldehyde.
(*c*) Cellulose nitrate.
(*d*) Cellulose acetate.

V. The following production targets have been recommended for the next five-year period :—

1.	Phenol-formaldehyde ...	...	1,500 tons per annum.
2.	Urea-formaldehyde ...	...	500 „ „ „
3.	Cellulose nitrate ...	...	2000 „ „ „
4.	Cellulose acetate ...	...	1000 „ „ „

VI. For a long range industrial development plan the production of the following synthetic plastics should be undertaken in the country.

(1) Melamine ; (2) Furfural-phenol ; (3) ; Nylon ; (4) Polyethylene ; (5) Alkyd ; (6) Vinyl ; (7) Acrylic ; (8) Silicone ; (9) Polystyrene.

VII. The Panel feels that there are extremely bright prospects of developing the naturally occurring resins for use in the plastics industry. Lac, bhilawan, cashew shell liquid etc., are some of the most promising materials available in the country. Intensification of co-ordinated research on their utilisation in plastics industry is strongly recommended.

VIII. The Panel recommends that the filler industry especially wood flour industry should be properly developed in the country. Besides wood, other fillers such as cotton and jute waste, mica etc. are also available in abundance in the country and can be successfully used as fillers in the plastics industry.

IX. The Panel feels that the plastics industry should be developed in India with the aid of extensive research both on synthetic and naturally occurring materials.

X. The Panel recommends that one factory manufacturing 50 million square feet of raw film of all types should be established in the country during the next five-year period.

XI. Since the raw film manufacture is a highly technical and specialized industry and the processes of manufacture employed are closely guarded secrets of a few foreign manufacturers, co-operation with some reputed foreign manufacturers is considered highly essential. The Panel is of the opinion that the Government should take the initiative in this direction and arrange with some foreign firm in the U.S.A., Germany or Belgium for assistance in establishing the industry in India. For this purpose it may be necessary to sponsor a joint venture with some foreign manufacturer.

XII. The Panel recommends that the development of the raw film industry should be in the following stages.

(*a*) coating and processing of imported film base ;

(*b*) Manufacture of film base in the country using imported chemicals ;

(*c*) Manufacture of raw materials and chemicals required for the production of film base.

XIII. The Panel recommends that the Government should give adequate protection to the industry in the form of subsidy, bounties or by any other means which will not adversely affect the motion picture producing industry. In view of the fact that the industry will use imported chemicals in the initial stages the Panel feels that the import of the chemicals used specifically for raw film manufacture, should be allowed duty free. The draw-back rebate system is recommended as suitable for this purpose. The Panel further recommends that concessional railway rates should be fixed for the movement of raw materials required by this industry and its finished products.

XIV. The Panel is of the opinion that a site near Poona is likely to be suitable for setting up a raw film factory. It is however recommended that the actual site should be settled in consultation with experts who may be employed for the purpose of developing this industry in India.

XV. The Panel recommends that the Government should, arrange to send at least 20 properly qualified young Indians abroad for specialized training in raw film manufacture. They should be trained for a period of two years in factories manufacturing raw films.

APPENDIX I

Progress in Plastics*

1875	Celluloid	... Sheets, rods, tubes
1904	Casein	... Thick sheets, rods
1909	Phenol-Formaldehyde	... Castings
1911	Cellulose acetate	... Sheets, rods, tubes
1919	Vinyl acetate polymers	... Adhesives
1922	Phenol Formaldehyde	... Laminated sheets
1924	Phenol Formaldehyde	.. Moulding powders
1924	Urea Formaldehyde	... Cast forms
1929	Urea Formaldehyde acetate	... Moulding powders
1929	Modified vinyl acetate	... Powders, films, sheets
1931	Acrylic esters	... Castings, mouldings
1931	Phenol Formaldehyde	... Modified cast resins
1931	Urea Formaldehyde	... Laminated sheets
1932	Methacrylic esters	... Castings, mouldings
1933	Vinyl benzene	... Moulding powders
1933	Cellulose acetate	... Injection moulding powders
1933	Benzyl cellulose	... Sheets, rods, tubes
1934	Celluloid and cellulose acetate	... Continuous extended sheets
1935	Vinyl chloride polymers and mixed polymers	... Sheets, rods, powders, films
1936	Phenol Formaldehyde	... Extended tubes
1936	Ethyl Cellulose	... Sheets and powders
1937	Urea-Formaldehyde	... Transparent moulding powders
1938	Casein	... Injection moulding powders
1938	Polystyrenes	... Transparent moulding powders
1939	Cellulose butyrate	... Moulding powders

* From *Modern Plastics* by Herbert R. Simmond.

APPENDIX II

Total Plastic Production in U. S. A*

Year	Production lb.	Sales		
		Quantity	Value $	Unit value $/lb.
1939	213,027,548	163,296,637	39,011,486	0·24
1940	276,814,363	201,099,650	59,368,339	0·30
1941	437,799,687	348,307,470	117,255,951	0·34
1942	426,731,106	373,185,293	149,680,000	0·41
1943	651,511,000	567,567,000	177,991,000	0·31
1944 (estimated)	700,000,000	...	...	...

*From *Modern Plastics*, Jan. & Sept. 1944.

APPENDIX III

Plastic Production in U. S. A

(Different Types)

Year	Acetate	Nitrate	Phenolic	Urea	Alkyd
1945	77,000,000*	15,000,000*	193,000,000*	45,000,000*	100,000,000* lb.
1944	65,023,000	15,951,000	158,944,000	47,972,000	112,685,000 lb.
1943	54,386,000	14,042,348	144,541,000	53,859,000	154,385,000 lb.
1942	48,246,000	15,128,826	122,440,978	37,515,785	91,237,362 lb.
1941	37,100,745	16,497,019	119,500,000*	28,780,000*	128,362,566 lb.

Chem. & Met. estimate.

APPENDIX IV*

Plastic Manufacturing Companies in U. S. A

	1941	1944
Compression Moulding	400	800†
Injection Moulding .:.	200	320†
Extruders ... ...:.		112‡

APPENDIX V*

Plastics Machines in U. S. A

	1941	1944
Compression	8,000	11,500
Injection	1,000	1,500
Extrusion (Non-wire coating)		350
Extrusion (Wire coating only)		330

Note :—In 1941 and 1942 these machines were mostly 2-, 4-, and 6-oz., while in 1944, at least 400 machines are 8-oz., or over. 400 machines of 8-oz. will consume as much or more moulding material than the remaining 1,100 older and smaller machines.

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* From *Modern Plastics*, Nov. 1944.

† About 160 of these operate both compression and injection machines so there is some overlapping.

‡ Includes all types of extrusion including wire coating, casein and nitrate.

APPENDIX VI

Firm	Type of Press	No.	Rating	Table Size	Lift	Heating	Temp. Control	Remarks
Angelo Bros.	Hydraulic, Own Make Accumulator Drive	3	50 Tons	16"×13"	18"	Gas	Hand control	
	do	6	25 „	13"×11"	18"	„	„	
	do	5	32 „	27"×30"	18"	Steam and water	„	Thermo Plastic Presses
Swadeshi Industries	...	4	100 „			Electric	Thermostatic	
India Moulding Co.	Hydraulic (Single Pump) Make : Wumag Gorlitz (German)	2	60 „	19"×19"	19"			
National Moulding Co.	Isoma. Inj. Moulding Press	1						
J. K. Industries	Mechanical Unit Elec. Motor Drive (Graber)	1	60 „	14"×14"	20"	Electric	Thermostatic	
	„	1	80 „	„	„	„	„	
	Manually operated Make (Graber)	1	20 „	„	„	„	„	
	„	1	30 „	„	„	„	„	
Kay Engg. Co.	Semi-Auto down stroke with Oil tank. Make : Ing. Vlatovsky	1	100 „	24"×24"	30"	„	„	

Firm	Type of Press	No.	Rating	Table Size	Lift	Heating	Temperature Control	Remarks
Kay Engg. Co.	Hydraulic Make : Ing. Vlatovsky.	1	100 tons	24" × 24"	30"	Electric	Thermostatic	
	Semi Auto Down Stroke Make : Ing. Vlatovsky	1	75 ,,	18" × 18"	18"	,,	,,	
	do	1	30 ,,	12" × 12"	18"	,,	,,	
	Semi Auto Down Stroke Make : H. Berry	1	50 ,,	18" × 18"	16"	,,	,,	
	Hydraulic hand operated. Make : Finny	1	50 ,,	22" × 22"	12"—H 20"—S	,,	,,	
Govt. Electric Factory, Bangalore	Crank operated Gotz	2	75 ,,	16" × 16"	24"			
,,	,, (Hand Drive)	8	50 ,,	15" × 15"	23"			
,,	,,	4	35 ,,	14" × 14"	20"			
,,	Toggle Presses	4	15 ,,	...	18"			
,,	Injection Moulding Press	1	2 oz.					
Asian Air Associates	Hydraulic (J. Shaw)	1	70 tons	17" × 14¾"	16"	Electric	Manual	fitted with thermo-couple
,,	,,	2	50 ,,	12¾" × 12¾"	16"	,,	,,	,,

Firm	Type of Press	No.	Rating	Table Size	Lift	Heating	Temperature Control	Remarks
Asian Air Associates	Hydraulic (J. Shaw)	1	28 Tons	12¾" × 12"	16"	Electric	Manual	Fitted with thermo-couples
Bake-O-Brass	Mechanical Unit Electrical Motor Drive	3	45 „	18" × 16"	16"	„	Thermostat	
„	Manual	2	30 „	14" × 14"	18"	„	„	
„	„	1	20 „	14" × 14"	18"	„	„	
„	„	1	15 „	—				
Bestolite	Hydraulic Unit Pump Wemag (2 Ram)	1	60 „	20" × 20"	20"	Electric	Thermostat	
„	Hydraulic Unit Pump Baker and Van Hullum	1	60 „	16" × 16"	24"	„	„	
„	Hydraulic (Finny) with screw	6	50 „	10" × 10"	6"(H) 14"(S)	„	„	
„	Hydraulic Unit Pump Baker and Van Hullum	2	80 „	20" × 20"	24"	„	„	
	Hydraulic Unit Pump Wemag (4 Ram)	1	60 „	18" × 19"	18"	„	„	
	Injection Moulding Press Echert and Zeigler	2	1 oz.					

APPENDIX VIII
LIST OF PLASTIC DIES

Electrical Accessories

No.	Description	Details	Remarks
1	Adaptor		
2	Artificial Horizon	2 components	
3	Bell Push		
4	Bullet tips	303 size	
5	Ceiling Rose	Top Cover type	
6	" "	Bottom " "	
7	" "	Ordinary	6 types
8	Cleats, wiring	5K/235	
9	" "	5K/237	
10	R.I.N. Switches	Insulating Components	
11	Condensor	6 mm	
12	"	6mm × 1¼/"	
13	"	11 mm	
14	"	6 mm & 11 mm Combined	
15	Crash Helmet	Body alone	
16	Cut outs	...	2 types
17	Fan bushes	Insulating bushes	
18	Fan components		
19	Flare trip wire	Body alone	
20	Fuse cut out		
21	Fuse	Main contact box	
22	Incendiary Bomb Comp.	Adaptor and cover	
23	Insulating bushes	...	21 sizes

APPENDIX VIII
LIST OF PLASTIC DIES

Electrical Accessories—(*Contd.*)

No.	Description	Details	Remarks
24	Insulators	Railway coupling	
25	Joint cut out	..	2 types
26	Junction boxes		2 sizes
27	Knobs	Radio Control	
28	Lampholder		
29	"	Cord grip type	
30	Merlin spares	Camshaft & blanking cover	
31	Transit Plug	2"	
32	" "	1·65"	
33	Plugs (2 pins without hand shield).		3 types
34	Plugs	2 Pin 5 Amp. with hand shield	
35	"	2 Pin 15 Amps	
36	"	3 Pin 5 Amps	
37	"	Dummy Aircraft Engine	
38	Push button	...	2 sizes
39	Rotor Dist. Knob	Chevrelet	
40	" " "	Ford	
41	Smoke box	Body and Cap	
42	Switches	S/P 5 Amps	6 types
43	"	Two way 5 Amps	2 "
44	"	D/P	2 "
45	"	S/P 5 Amp with fuse	
46	"	Motor Car	
47	Switchgear	Bars & Separators	
48	Socket & Switch combined		

Household Articles

No.	Description	Details	Remarks
1	Ash Tray	...	4 types
2	" " Flat	7 3/4" dia × 1" ht	
3	" " for cigars	4" × 1 1/8".	
4	Ash Tray	with bowl base	
5	" "	with cover	
6	Baby Soother	Ring and washer	
7	Bearing for silk mill	1" dia	
8	Bottles	For rifle oil	
9	Bottle caps	16 oz	4 types
10	" "	4 oz	2 types
11	" "	5/8" dia. × 3/4" depth.	
12	" "	...	3 types
13	" " Ink	...	2 types
14	Bowls	4 5/8" × 2"	
15	"	3" dia × 3/4"	
16	"	3" dia × 1 3/8"	
17	"	Finger 3 5/8" × 2 1/4"	
18	"	Flat 5 1/4" × 1 5/8"	
19	"	Hemispherical 5 3/4" × 3"	
20	"	3 3/4" × 2 1/8"	
21	"	3 3/4" × 2"	
22	"	4 1/2" × 2 1/4"	
23	"	3 9/16" × 1 7/16"	
24	"	3" dia × 1 1/4" depth	
25	"	3 1/4" dia × 1 3/4" ht	

No.	Description	Details	Remarks
26	Bowls (for Powder with screw lid)	2·3/4" dia.×2·1/4" ht	
27	,, Ash	4" dia.×2·1/2" ht	
28	,, ,,	3·9/16"×2·1/4"	
29	,, ,,	with screw lid	
30	Box with lid	4·1/2"×3·1/4"	
31	,, ,, ,,	3·1/4"×2·3/4"×15/16"	
32	Box with lid	Round 13/4" dia× 1·5/8" depth	
33	,, ,, ,,	Round 2·3/4" dia× 5/8" depth	
34	,, ,, ,,	Round 2·3/8" dia× 7/8" depth	
35	,, ,, ,,	Round 1·5/8" dia× 1·5/8" depth	
36	Box Bagdad		
37	Box for typewriter ribbon	2·1/2" dia × 3/4" depth	2 types
38	Box perfumery	3·1/8"×2·3/8"	
39	Box (Powder) with lid	3·13/16"×2·3/4"	
40	,, ,, ,, ,,	3·9/16"×1·9/16"	
41	,, ,, ,, ,,	1·5/8" dia × 3" depth with sieve	
42	,, ,, ,, ,,	...	2 types
43	Box (Powder)	3·9/16"×2"	
44	,, ,,	with pedestal	
45	Caps for (Pomade Jar)	...	6 sizes
46	Cap for large Jar	2·3/8"×7/32"	
47	Cap for toothpaste tube	No. 95 Thread	
48	Cap Kores fluid	...	
49	Case for Cigarettes	3·1/2"×3"×2"×1/4"	

No.	Description	Details	Remarks
50	Comb	7 1/2" long	
51	,,	7" narrow teeth	
52	,,	3 1/2" teeth 3" handle	
53	,,	—	
54	Container	2 oz	2 types
55	,,	1 1/2" oz	
56	,,	4 oz	
57	,,	1 oz. with screw lid	
58	,,	1 lb. ,, ,, ,,	
59	,,	1/2 lb. ,, ,, ,,	
60	,,	1 1/8" × 5/8" ,, top	
61	,,	2 1/2" × 2 1/4" ,,	
62	,,	1 5/8" × 1 13/16" ,,	
63	Container	3/4" × 1 1/4" with screw top	
64	,,	2 1/8" × 1 1/2" ,, ,, ,,	
65	Container Food	—	11 sets
66	Container for pills	1 1/8" × 4 1/16" with screw top	
67	,,	1 1/2" × 4 1/8" with screw top	
68	Cup	Ordinary	6 types
69	,,	3 3/4" × 2 1/4"	
70	,,	3 3/16" × 1 7/8"	
71	,,	4 1/4" × 2 3/4"	
72	,,	2 7/8" × 1 3/4"	
73	,,	3 3/8" × 2 1/2"	
74	,,	2" ×	
75	,,	2 3/4" × 1 5/8"	

No.	Description	Detail	Remarks
76	Cup	3·1/8" × 1·5/8"	
77	"	with pedestal	
78	Cup for egg	1·5/8" × 1·5/8"	
79	Desk pad	7" × 4"	
80	Dubbies	—	3 types
81	Efar Knobs	—	
82	Eye Glass	frame and ring	2 types
83	" "	frame and ring to fit lens 2" dia	
84	Gum pot with lid	2·1/2" × 2"	
85	Ink Stand	Single Cavity	
86	" "	Double Cavity	
87	" "	with cigarette case 4" × 2·1/2" × 1/4"	
88	Knife, paper	8·1/2" long	
89	Knobs	with locking catch	2 types
90	Lampshade	8" dia.	
91	Lens holder	24 mm dia	
92	" "	for reading glass 3·1/8" dia. × 7" long	
93	Lens holder	—	
94	Napkin Ring	—	
95	" "	Semi-circular	
96	" "	1·9/16" dia × 1·1/16 ht	
97	Note Block	—	
98	Nozzle	for 4 holes	
99	Oil bottle	with metal screw	

No.	Description	Details	Remarks
100	Pepper & salt sprinkler	15/16" × 2 3/4"	
101	" " "	1 1/4" dia × 2 1/2" ht	
102	" " "	1 1/8" × 1 7/8"	
103	Pin Tray	2 3/8" × 3/4"	
104	Plate	6 1/2" dia	
105	"	4 5/8" × 1/2"	
106	"	9 3/4" × 3/4"	
107	"	7/8" dia	
108	"	5 3/4" × 3/4"	
109	"	6 3/4" dia × 1" ht	
110	"	4 7/8" × 13/16"	
111	"	5" dia	
112	"	7" dia	2 types
113	"	8 7/8" dia	
114	"	5 7/8" × 1 1/4"	
115	"	6" dia	
116	Plates Other Varieties.	—	3 sizes
117	Pot Chutney	—	
118	Pot Mustard	1 1/2" dia × 1 1/4" ht with spoon	
119	Pot Picnic	—	
120	Pot Kunkum	1 5/8" dia × 1 1/8" with screw lid	
121	Razor Safety	Gillette type	
122	Saucer	4" × 3/4"	
123	"	3 3/4" × 1/2"	
124	"	3 1/2" × 1/2"	

No.	Description	Details	Remark
125	Saucer	5·3/8" dia	2 types
126	,,	5 1/2" dia	
127	,,	7·1/4" dia	
128	,,	5·3/6" × 1·1/16"	
129	,,	9" dia	
130	Shaving block Container	2·9/16" × 1·3/4"	
131	Shaving Cup	...	3 types
132	Shaving Stick Container	1·7/16" × 3·1/8"	
133	,, ,, ,,	1·3/8" dia × 3" ht	
134	,, ,, ,,	other sizes	2 types
135	Shaving Set	Incl. box and bracket	
136	Soap box	3·5/8" × 2·1/8" (roun l)	
137	,, ,,	3·7/8" × 2·3/4" × 1·1/2" (with lid)	
138	,, ,,	3·1/2" × 2·3/8" × 1" (with lid)	
139	,, ,,	3·3/4" × 2·1/2" × 1·1/4" (with lid)	
140	,, ,,	3·3/4 × 2·1/2" × 1·1/4" (with lid)	
141	,, ,,	4·1/2" × 3" × 3/4" (Oval)	
142	,, ,,	other sizes	8 types
143	Spool	3·7/8" dia of cheeks 3" dia of body 1·1/2" ht. 1/8" thick 1/2" hole	
144	,,	Cheeks: 2" dia 1/8" thick Body: 1·1/16" dia out 7/8" inside dia. 2" long	
145	,,	Cheeks: 1·3/8" dia × 1·1/8" thick Body: 5/8" out dia 7/16" inside dia 1" long	
146	,,	Cheeks: 1·7/8" dia. × 1/8" thick Body: 9·7/8" long 3·1/32 dia hole 3/4"	

No.	Description	Details	Remarks
147	Spoon	5" long	
148	,,	4 7/8" long	
149	,,		
150	Stand for Calendar	8 1/2" × 7"	
151	Stand for tumbler	4" dia	
152	Strainer tea	2 15/16" × 1"	
153	Sugar Pot	2 5/8" × 1 7/8"	
154	Terminal block	3 way	
155	Tobacco box cover	—	
156	Tooth brush	6 1/2" long	
157	Tray	round	
158	,,	8 7/8" dia × 1/8" deep	
159	Tumbler	2 1/2" × 3 3/4"	
160	,,	3 3/8" × 4 1/8"	
161	,,	2 1/8" × 3 3/8"	
162	,,	2 1/2" × 3 15/16"	
163	,,	2 3/4" × 4 3/8"	2 types
164	,,	3" × 3 1/2"	
165	,,	2 9/16" × 3 1/2"	
166	,,	other sizes	6 sizes
167	,, Nestling	A set of 4 tumblers	
168	Washers	1/2" dia out × 1/4" dia inside	—
169	,,		
170	Whistle	1 3/4" long × 1 9/32" width	

Oil Hardening Cast Steel

E.g., Balfour's NSS. 3 (such as is commonly used in man. of press tools).

3/4"	×	4"	×	15'
7/8"	×	4"	×	15'
1"	×	4"	×	15'
1"	×	5"	×	15'
1"	×	6"	×	15'
1·1/8"	×	6"	×	10'
1·1/4"	×	6"	×	10'
1·1/2"	×	6"	×	10'

Special Hobbing Steel

This is a fine grain steel, of high compressive strength and great resistance to distortion, under extreme pressure, when heat treated.

E.g. JESSOP'S ALLOY C

1·1/2"	dia	bar		8'
2"	"	"		8'
3"	"	"		8'
1·1/2"	×	1·1/2"	×	8'
2"	×	2"	×	8'
3"	×	3"	×	5'

5% Nickel Case Hardening Steel

1·1/8"	dia.	bar	15'	1·3/4"	dia	bar	15'
1·1/4"	"	"	15'	2"	"	"	10'
1·3/8"	"	"	15'	1·1/2"	"	"	15'

Mild Steel (Round and flat bars, billets, sheets) and ·4 — ·5% carbon steel (forged billets) are readily available in India.

APPENDIX VIII

List of Plastic articles and approximate annual production target during next five-year period

Articles	Annual production target (*units*)	Quantity of Moulding Powder (*required*)
Soap-boxes	7,000,000	400 tons
Combs	4,500,000	100 ,,
Ash-trays	900,000	50 ,,
Cups and Saucers	800,000	75 ,,
Tumblers	1,200,000	75 ,,
Bowls (for shaving, ash, pins, etc.)	10,000,000	100 ,,
Cigarette and Cigar cases	1,500,000	100 ,,
Large and small dabbis, powder boxes, etc.	2,000,000	120 ,,
Electrical fittings, switches, terminals casting, etc.		150 ,,
Domestic utility items such as plates, spoons, etc.		100 ,,
Industrial articles, umbrellas handles, telephone parts, stationery boxes, etc. ribbon containers.		300 ,,
Advertising novelties, desk calendars, pads, etc.		250 ,,

In addition to the above, it is recommended that the country should undertake the manufacture of the following articles :—

Tooth brush handles	20,000,000	125 ,,
Mirror frames.	400,000	6 ,,
Fountain pen barrels	100,000	1-1½ ,,
Buttons, buckles etc.	30,000,000	150 ,,
Bottles-caps, caps for jars, containers etc.	2,000,000	10 ,,
Radio parts, cabinets etc.	50,000	50,000
Coat hanger (@ 20,000 per ton)	5,000,000	250 ,,
Curtain rods (@ 10,000 ft. per ton)	100,000	10 ,,
Curtain rings,	500,000	3 ,,
Trays (household etc.)	50,000	10 ,,
Hair pins etc., brushes	10,000 000	15 ,,
Games : Back-gammon, Chess Dominoes	10,000	20 ,,
Children toys, bath-tubs, -blocks, dolls, rattles, trains, etc.	25,000	50 ,,

The use of cellulose ester materials for injection moulding is recommended in the manufacture of : —

Tooth-brush handles, fountain pen barrels, buckles, combs, spectacle frame, paper-cutters, hair pins, knitting needles, etc.

APPENDIX IX

Main uses of Phenol Formaldehyde Plastics

Moulding Powder	Cast	Stoving Lacquer	Laminates
			contd.
Radio part	Electric components	Metal coverings	Cabinets
Telephone parts	Telephone insulation		Desk & Table Tops
Motor car fittings		Insulating varnish	Counter Tops
Aeroplane fittings	Radio knobs	*Oil Soluble Resins*	Partitions
Heat insulation components.	Radio cabinets	Paints	Industrial Machinery
Electric meters	Industrial cabinet housing	Varnishes	Tray
Circuit beakers	Buttons	Enamels	Name plates.
Switches	Buckles		
Plugs	Knife handles		
Sockets	cutlery handles	*LAMINATES.*	
Cut outs	Kitchen utensils	Electric insulation parts	
Ceiling roses	& handles	Radio parts	
Lamp holders	Brush backs	Telephone parts	
Handles, closures, knobs	Ash trays	Metre housing	
Housings	Closures	Telephone boothes	
Trays	Packagings	Structural components	
	Sculptures	Decorative panelling	
Ash trays		Pulleys	
Camera cases	Interior lighting fixtures	Handles	
Closures	Gear shift knobs	Gear wheels	
		Bearing.	
Packagings	Industrial letters for signs.	Brake linings	
Gramophone records	Iron exchange phenolics	Clutch linings	
Mill parts	Decoration and display articles	Sleeving	
Corrosion resistant application	*Cold Selling Glue*	Bushes.	
Displays	Wood gluing		
Miscellaneous, general utility components.	Plywood manufacture		
	Abrasives manufacture.		
	Low Temp. Hardening Lacq.		
	Resistant wood finishes.		

APPENDIX X

Main uses of Urea Formaldehyde Plastics

Moulding Powder.

Tablewares
Electrical fittings
Switch plates
Handles and knobs for radios, elect. appliances, stoves, cabinets, fixtures and automobiles.
Housing for radio, clocks and scales
Reflectors
Illuminated dials
Buttons
Buckles
Bottle and tube caps
Covers for jars and boxes
Cosmetic containers
Refrigerator parts
Hardwares
Boxes for jewellery & watches
Toys and Novelties
Keys for piano and organs
Packagings
Decorative purposes & displays.

Cold Setting Glue.

Aeroplanes construction
Plywood manufacture
Furniture

OIL SOLUBLE RESINS

Paints
Varnishes
Enamels
Textile finishes

LAMINATES

Panelling
Furniture
Radio sockets and Terminal boxes.
Sculptures.

APPENDIX XI

Main uses of Cellulose Nitrate and Cellulose Acetate

CELLULOSE NITRATE.

Sheets, rods and tubes

Knife handles
Brush handles
Tooth brush handles
Tool handles
Cutler handles
Brush backs
Knobs
Fountain pens
Pencils
Combs
Buckles
Mirror frames
Toys
Picture frames
Novelties
Window shields
Tube covering
Soap cases

PROTECTIVE COVERINGS

Lacquers
Dopes

FILMS

Photo films
Cine films

Moulding Powder

Combs
Pens
Pencils
Buttons
Containers
Closures (bottles & jars)
Spectacle frames
Covering
Steering wheel
Telephone housing
Meter terminal blocks
Electrical parts
Tableware
Vases
Trays
Displays
Packagings
Sculptures
Buisiners active keys
Musical instruments
Jewellery and watch crystals
Radio knobs

SHEETS, RODS & TUBES

Eyeshields
Pens
Pencils
Spectacle frames
Windowshields
Radio dials and knobs
Lampshades and lighting accessories
Aircraft parts

CELLULOSE ACETATE

Sheets, rods and tubes

Containers
handles & knobs
Insulation tubes
Displays

FILMS

Photofilms

FILAMENTS

Acetate rayon

APPENDIX XIII

Raw Materials & Chemicals required in Raw Film Manufacture (From Mr. M. S. Patel)

For the production of 1,000,000 square feet of 35 mm motion picture film on nitrate base, assuming a ratio of 16 to 1 Negative to Positive, the following raw materials are needed :—

Nitro-cellulose	Approx.	42,000	lbs.
Acetone	,,	550	,,
Alcohol	,,	77,500	,,
Ether	,,	130,000	,,
Methanol	,,	14,200	,,
Camphor	,,	3,400	,,
Gelatin	,,	240	,,
Emulsion Gelatin	,,	3,250	Kgs.
Silver Nitrate	,,	1,550	,,
Potassium Bromide	,,	1,200	,,
Potassium Iodide	,,	72	lbs.
Sensitizing Dyes	,,	1 500	Grms.

For the production of films of a different pattern, consisting of about 25% motion picture film on the above mentioned ratio, 25% roll films, 25% high-speed X-ray film and 25% of the various other sheet films on a basis of 1,000,000 total square feet, the following figures are supplied :—

Nitre-cellulose	Approx.	17,300	lbs.
Acetyle Cellulose	,,	21,400	,,
Acetone	,,	98,000	,,
Alcohol	,,	31,600	,,
Ether	,,	51,800	,,
Methanol	,,	15,800	,,
Camphor	,,	1.450	,,
Acetate Plasticizer	,,	4,400	,,
Gelatin	,,	255	,,
Emulsion Gelatin	,,	3,000	Kgs.
Silver Nitrate	,,	1,700	,,
Potassium Bromide	,,	1,600	,,
Potassium Iodide	,,	60	,,
Ammonia	,,	690	Litres
Sensitizing Dyes	,,	1,000	Grms.
Coating Gelatin	,,	4,000	Lbs.
N. C. Dyes for non-curling layer		95	Kgs.

The above figures are based on using fresh materials and no allowance is made for recovery.

APPENDIX XII

Imports of Films in India, 1935–36 to 1943–44.

Cinematographic Films	1935–36		1936–37		1937–38		1938–39		1939–40		1940–41		1941–42		1942–43		1943–44	
	Length in feet	Value Rs.	Length in feet	Value Rs.	Length in feet	Value Rs.	Length in feet	Value Rs.	Length in feet	Value Rs.	Length in feet	Value Rs.	Length in feet	Value Rs.	Length in feet	Value Rs.	Length in feet	Value Rs.
1. Raw Films	41,666,534	21,62,262	67,832,411	37,73,899	75,937,107	25,44,444	74,215,451	24,90,737	92,953,301	31,02,767	70,028,385	24,29,599	92,536,895	30,74,714	86,512,767	31,09,738	79,757,643	29,92,373
2. Exposed Films	6,820, 808	25,80,421	9,637,998	24,09,567	22,295,336	38,14,738	26,004,479	37,68,525	13,811,454	54,18,565	10,367,301	50,43,253	17,122,184	51,09,518	4,821,468	18,06,806	10,089,021	38,48,854
3. All others	—	33,02,795	—	30,06,153	—	32,20,367	—	26,96,680	—	31,07,154	—	32,43,372	—	37,01,289	—	28,06,557	—	18,11,946
4. Cinema tube apparatus Equipments*	—	—	—	11,84,513	—	18,12,411	—	13,81,204	—	7,69,310	—	10,71,317	—	11,20,925	—	3,36,450	—	2,03,729

*Separately recorded from 1936-37. (From Sea Borne Trade)

DIS. 10
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GOVERNMENT OF INDIA

DEPARTMENT OF INDUSTRIES

AND

SUPPLIES

Cx. O. 3%

REPORT OF THE SILK PANEL

PRINTED IN INDIA BY THE MANAGER
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GOVERNMENT OF INDIA

INDUSTRIES AND SUPPLIES DEPARTMENT

REPORT OF THE SILK PANEL.

INTRODUCTORY.

In consonance with the policy of rapid industrialisation of the country, the Government of India appointed a number of panels, with the function of making recommendations to Government regarding the development of industries, both existing and new. These recommendations were to be so framed as to enable Government to prepare a detailed phased plan for the five years following the cessation of hostilities, as the first stage of a 15-year plan of industrial development for the whole country.

2. In order to assist them to formulate recommendations, Panels were to be supplied as far as possible, with factual information prepared by the panel secretaries. A directive was also furnished specifying the points which the Panels were expected to cover in their recommendations. The directive is given as appendix (a).

3. In pursuance of this scheme the Panel on Silk was constituted (vide No. P-1(23)|44 dated 8th March 1945) with the following personnel :—

Chairman :—Rajasevaprasakta Navaratna Rama Rao.

Members :—

Rai Bahadur S. N. Bose

Mr. R. Peychaud

Mr. H. Pulman

Mr. S. Ratnam

Secretary :—Mr. Humayun Mirza, Assistant Industrial Adviser.

4. In accordance with paragraph 2 of the General Directive, the Secretary proceeded with the work of collection of factual data by issuing questionnaires to the Governments of the various silk-producing Provinces and States. On the basis of the information received, the Secretary prepared the Preliminary Report for the consideration of the Panel.

5. The Panel wish to place on record their sense of gratitude for the whole-hearted co-operation of these Governments and their Sericultural Departments; and they are in a very special sense indebted to the Development Minister of Jammu and Kashmir, the Superintendent of Sericulture in Mysore, and the Directors of Industries of Madras, Bombay, Punjab, Bengal, Assam, Bihar and the Central Provinces.

6. The Silk Panel held seven meetings on the dates given below :—

13th and 14th August 1945—at New Delhi.

15th April 1946—at New Delhi.

13th and 14th June 1946—at Bangalore.

25th September 1946—with the representatives of the Provinces and States at New Delhi, and

26th September 1946 at New Delhi for the consideration of the suggestions received from the representatives at the meeting on the previous day.

After the meeting on the 15th April 1946, the Silk Panel prepared and submitted to Government a Provisional Memo. of findings and recommendations agreed upon as the result of discussions on the material so far available. The meetings on the 13th and 14th June 1946 were held at Bangalore to fill up certain lacunae in factual information relating to moriculture and the spun silk industry, and advantage was also taken of the opportunity for a frank discussion with the official and non-official representatives of the sericultural industries of Mysore and Madras.

7. The present report in effect expands and elucidates the points raised and views expressed in the Provisional Memo. with the addition of matters on which factual information became available subsequently. The portions relating to the spun silk industry, and improvement of moriculture are instances in point. The recommendations of the Silk Panel have been framed as far as possible to cover the points specified in the Government of India directive. As an accurate and comprehensive review of the present state and potentialities of an important Indian industry, and as containing a carefully thought out plan for realising those potentialities, this result of the Panel's labours might, it is hoped, be of use not only to the Government of India, but to the public interested in sericulture.

8. The Panel wish to record their appreciation of the very able, enthusiastic and painstaking manner in which Mr. Humayun Mirza has collected a vast amount of material, sometimes with great difficulty. While his intelligent presentation of the factual information facilitated our work his unfailing courtesy made it a pleasure.

Scope of the Enquiry and Nature of the Industry.

9. The Silk Panel have confined their enquiry to sericulture proper, comprising all the operations from the cultivation of mulberry to the production of raw silk and spun silk. They have not dealt with the non-domesticated silk worms—the tassar, the muga, and the eri—for their distribution is confined to definite localities making them a local rather than an all-India Interest; the scope for their development is also limited. They recommend however that Provincial Committees of Experts might be constituted to investigate the problems connected with the development of these industries. The Panel did not concern themselves with the utilisation of raw silk, which they considered properly to come under weaving.

10. The sericultural industry of India is an important national asset with strongly marked characteristics. It consists of two well defined sections :

(1) The production of cocoons; and

(2) The production of raw silk, including the utilisation of by-products.

11. While the first part is essentially a cottage industry subsidiary to agriculture, the second is a factory industry utilising the collected output of the first. There have been no recorded instances of silk worm rearing having been successfully practised otherwise than as a home occupation ; and though small scale reeling with primitive appliances is still practised in villages, this is undoubtedly a late survival of an obsolete system doomed to speedy disappearance. The reeling or factory part of the industry may be regarded as the culmination of sericulture, since its function is to convert the cocoons produced by the several village homes into raw silk which is a world commodity. There is a division of work and a mutually beneficial co-ordination of functions between the two sections. This distinction and inter-dependence must be borne in mind in formulating any policy for the industry as a whole. The first section of sericulture which consists of all the operations from the cultivation of mulberry to the harvesting of cocoons has certain definite characteristics. It is extremely sensitive to psychological influences. It would be no exaggeration to call it an industry based on domestic hopes and fears, dependent almost wholly on the home's ability and inclination to work, and involving no great commitment in the way of capital. If the return from work seems no longer worthwhile, or the home suffers losses, it gives up rearing silk worms, and the field is cleared of mulberry and cultivated with other crops. The predominance of the human factor which makes the industry so sensitive, also invests with a special human value as making

it an efficient instrument of welfare and employment. In fact, it is in India the home industry *par excellence* since everything which can be claimed for domestic cotton spinning can be claimed equally for sericulture with the difference that the returns may be in silver instead of in nickel.

12. While the human interest of the industry would of itself entitle it to the solicitude of the State, its importance as the source of an essential material of war places it high in the scale of national values.

13. The reeling of silk worms is an operation which in advanced sericultural countries is conducted in well equipped filatures. In India, till recently, reeling was much the most backward part of the industry. Even before the outbreak of war, experience of well reeled imported silk created a discontent with the charka product, and the instinct of self-protection led to a beginning in the establishment of filatures. The stifling pressure of foreign competition resulted in an all-India cry for protection which led to the appointment of two Tariff Boards in 1933 and 1938.

14. The protection granted as a result of the recommendations of the first Tariff Board having proved insufficient, the second one was appointed. Before any action could be taken on the report of the latter, the outbreak of war rendered tariff protection unnecessary, and brought to Indian silk its due recognition. Since a large quantity of filature silk was required for war purposes, Government specially stimulated the development of filatures, and gave sericulture an impetus such as it had never had before. The impulse is now exhausted, and the present problem is how to safeguard against collapse the industry which the State expanded for its own purposes and which is also an essential national asset.

First Quinquennium.

15. The target recommended by the Panel for the first quinquennium of the plan is the maintenance and consolidation of the present position of the industry.

16. The total cessation of foreign imports into India on the outbreak of war, acted, as might be expected, as a powerful stimulus to Indian sericulture. Against an Indian consumption of over 10 million pounds of silk and silk products per year, India was at that time producing less than 1-1|4 million pounds. The urgent war-need of the United Nations for silk of the highest quality for the fabrication of parachutes and other purposes created a new and imperative demand for the best grade of filature silk. Meanwhile, the diminution of imported consumers' goods in India increased the purchasing power of the classes who constituted the main market for silk. In these circumstances the prices of silk shot up to unprecedented heights. Sericulture being an extremely sensitive industry, it responded rapidly to this stimulus. The statement given below sets forth the rise in prices :

17(a) *Statement showing the average prices realised in the auction sales of Silk received in Mysore Government Depots from* 15-10-43 *to* 31-5-45.

(Courteously furnished by the Special Officer for Silk Filature Expansion Scheme).

Average prices realised for lbs. of

Month of sale.	Rejected Filature Silk. 1	"AAA" 2	"AA" 3	"A" 4	"B" 5	"C" 6	"CC" 7	Inferior 8	Duppion. 9
1943.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
November	..	..	41 0 0	41 0 0	35 4 0	30 4 0	27 12 0	25 8 0	18 8 0
December	..	..	41 14 0	38 0 0	35 8 0	30 8 0	28 6 0	28 10 0	17 9 0
1944.									
January	..	..	43 0 0	40 0 0	37 0 0	35 4 0	34 2 0	29 6 0	16 6 0
February	..	..	42 0 0	41 8 0	39 5 0	37 3 0	36 8 0	33 12 0	20 13 0
March	..	..	44 0 0	41 0 0	40 5 0	39 0 0	38 4 0	31 0 0	22 0 0
April	..	59 0 0	49 4 0	45 14 0	42 8 0	40 1 0	38 2 0	30 0 0	21 4 0
May	55 0 0	38 0 0	38 0 0	40 0 0	38 0 0	33 0 0	31 0 0	22 8 0	19 0 0
June	..	35 4 0	34 14 0	38 0 0	36 8 0	31 10 0	30 8 0	27 0 0	19 8 0
July	..	82 7 0	66 0 0	55 5 0	45 4 0	43 0 0	38 12 0	34 0 0	25 8 0
August	93 0 0	90 8 0	87 13 0	66 14 9	53 14 0	45 15 0	46 0 0	40 0 0	30 0 0
September	..	81 0 0	68 9 0	52 12 0	43 11 0	39 12 0	36 8 0	31 0 0	27 15 0
October	61 0 0	..	56 0 0	48 2 0	39 0 0	36 10 0	35 0 0	31 0 0	23 9 0
November	61 0 0	56 0 0	48 13 0	39 1 0	32 7 0	30 4 0	25 1 0	25 8 0	18 13 0
December	..	60 0 0	59 11 0	48 9 0	42 1 0	34 3 0	33 8 0	31 10 0	27 0 0
1945.									
January	..	72 0 0	62 11 0	60 3 0	50 9 0	43 0 0	40 0 0	33 4 0	19 8 0
February	..	82 5 0	74 13 0	60 0 0	52 0 0	44 1 0	42 8 0	37 4 0	30 2 0
March	..	112 0 0	94 0 0	82 9 0	70 15 0	68 1 0	60 0 0	45 0 0	25 5 0
April	..	118 0 0	108 1 0	79 15 0	66 6 0	61 6 0	56 8 0	40 4 0	29 8 0
May	102 0 0	72 0 0	63 0 0	61 14 0	53 7 0	50 1 0	45 8 0	35 4 0	22 0 0
June	..	71 0 0	67 0 0	63 13 0	53 15 0	46 5 0	44 0 0	36 4 0	22 8 0

(b) During this period filature silk (except small quantities, rejected by the Ordnance Depot) was not available for the civilian market. It was all being supplied to the Government of India at a formula-price which was round about Rs. 29 per lb.

18(a) The following figures which show the increase in the acreage under mulberry (acreage under mulberry being an index of silk production at any given period) show the extent of expansion during the war.

	1938-39.	1939-40.	1945-46.
Mysore	27,187	30,000	78,000
Madras	5,725	5,720	18,026
Bengal	(not available)	8,893	15,516

(b) During this period there was a far-reaching change in the nature of the reeling. Since an essential part of the demand was for filature silk fit for military purposes the establishment of filatures was encouraged by the Government of India acting through the Provincial and State Governments, and the number of filature basins increased almost fourfold in consequence.

19. Filature silk was sold to the Government at prices fixed on the cost of production which were very much less than the prices which could have been realised in the open market. It is thus clear that the sericultural industry which expanded during the war rendered vital service to the State at considerable sacrifice to itself. It has for this reason also a claim to the solicitude of the Government. If the industry is left unsupported at this stage it is not improbable that it may shrink —or even collapse—as rapidly as it expanded. This would not merely result in throwing lakhs of homes out of employment but would seriously injure an asset which is an important source of war strength.

Maintenance and Consolidation. The Target in first Quinquennium.

20. The Silk Panel are therefore of opinion that the first quinquennium should be devoted primarily to the maintenance and consolidation of the existing silk industry of India. It goes without saying that an industry which has expanded against time, so to speak, and under extraordinary circumstances which exist no longer, must have many weak links in its organisation. By consolidation the Panel mean, the strengthening of all weak links and the organisation of the industry to adapt it to post-war conditions and to meet foreign competition. The Panel consider that the main directions of consolidation may be grouped as below :—

Requisites of Consolidation.

(1) Improvement of mulberry cultivation,

(2) Adequate supply of disease free seed, and improvement of quality,

(3) Control of Silk Worm Diseases,

(4) Improvement of rearing, reeling, organisation and marketing,

(5) Development of the Spun Silk Industry and full utilisation of by-products and

(6) Inter-Provincial-and-States co-operation in regard to these objectives.

I.—Improvement of Mulberry Cultivation.

21. Upto the present time the varieties of mulberry planted and methods of cultivation in the several provinces and states were governed by custom. In some provinces experiments with the object of ascertaining and popularising better varieties and better methods of propagation and cultivation had been carried out and some valuable results had also been obtained. The Panel are of opinion that the improvement of moriculture or mulberry cultivation should receive special attention. The cost of mulberry represents nearly 60 per cent. of the cost of production of cocoons, and at a time when every effort should be made to reduce cost, the cost of mulberry cultivation is undoubtedly the end at which the problem of reduction could be best tackled. The representatives of the Provinces and Mysore were emphatically of opinion, with which the Panel fully agreed, that the regional Governments concerned should start an adequate number of mulberry farms of sufficient extent at strategic points over the sericultural area for experiments with different varieties of grafted and budded mulberry trees. These farms should also serve as nurseries for distribution of varieties found suitable. The object should be to increase both the yield and the nutritive value of the leaves.

Government Mulberry Farms and Nurseries.

Research in Mulberry.

22. Mr. A. T. Janakiram, the Madras Silk Expert, has prepared a 5-year plan of development which includes this work. The Panel recommend the preparation of similar plans for the other provinces and states.

23. While on this subject, the Panel would like to make a few observations on the feasibility of introducing the cultivation of tree mulberry in the provinces and states where the prevailing method of raising it is bush cultivation. These observations have no reference to Kashmir where the conditions are entirely dissimilar to those in other parts of India. The advantage in raising mulberry trees is that the cost of maintenance of an acre bearing such trees is less than a third of that of the same extent of bush, and the cost of leaf per pound is about a half. (See the figures given on pages 54-55 of the Report of the Indian Tariff Board, 1940). Against this is to be set off the fact that the yield from an acre of trees is considerably less than that from an acre of bush. There is an impression, so far not fully confirmed by scientific observation, that leaves from trees offer some advantages in the

Tree Mulberry as a Supplement to Bush Mulberry.

rearing of foreign race worms. The Panel attempted to assess the comparative merits of tree plantation and bush from the point of view of economy. They had the advantage of discussion of this point with the representatives of Madras and Mysore who had some experience and opportunities for comparison. The opinion of the Panel, which was concurred in by those representatives, was that the balance of advantage is not decisively on the side of tree plantations. Trees may be suitable for inferior land, for lands far from villages, and lands which are not being utilised for other purposes at present. Compared to the bush, tree cultivation is extensive and not intensive in method, and therefore might be adopted only where the value of land is not great. At a time like the present when agricultural resources have to be husbanded and made the most of for food production, any method of cultivation which requires more land for the same quantity of produce would be a national waste. Mr. Shamsuddin Khan stated from experience that the impression that trees needed less care than bush was not correct, as trees were susceptible to diseases, such as fungus and dry-rot, which destroyed them, and that they required attention and timely care. Mr. H. S. Govinda Rao, Superintendent of Sericulture in Mysore, said that the idea was not to substitute tree for bush, but to supplement the bush with trees by utilising uncultivated margins of land and land which bore no crop. The Panel are in agreement with the opinion of the representatives from Mysore.

Consolidation and Improvement more Important than Expansion.

24. While on this subject the Panel wish to emphasise that at the present stage, improvement and consolidation of existing area under mulberry is vastly more important than extension. Their reasons for this conclusion are :

(1) The output of mulberry leaves per acre can be increased considerably by the introduction of better varieties and more effective cultural methods.

(2) Sericulture being a home industry the most useful way of increasing leaf production is intensive cultivation of land close to villages rather than cultivation of outlying land whereby labour would be wasted in covering the distance between home and garden.

(3) Mulberry has reached its present extent by means of natural adjustment relatively to food crops. Further extension raises acutely the question of their relative national importance. The Panel do not wish to make proposals which might tend to disturb this equilibrium at the present time.

(4) Mulberry cultivation has even now much out-grown the capacity for production of examined silk worm eggs, and perhaps the most difficult problem with which sericulture is faced is to develop the latter sufficiently to restore the balance. Further expansion of mulberry would immediately worsen the disproportion, and add to the already great difficulties of the

problem of seed production. These considerations do not apply to Provinces and States which have no sericulture at present, and which wish to take it up newly as suited to their conditions. There may be as yet unexplored potentialities in Bombay, Hyderabad and Travancore. Utilisation of such virgin resources, if initiated and developed on sound lines, would undoubtedly be an addition to the national asset.

II.—Adequate Supply of Disease Free Seed.

25. The total area now under mulberry in India, excluding Kashmir, is 1,12,632 acres. In Kashmir there are roughly 1,500,000 trees. Each province and state has its own peculiar problems in regard to seed. In Kashmir the seed reared is univoltine; and before the war about a half of it used to be imported from abroad. When foreign sources failed owing to the outbreak of hostilities, Kashmir was thrown very much on her own resources. During 1944-45 out of a total requirement of 58,113 oz of seeds as much as 42,025 oz were locally prepared. While on the one hand concentration of seed production and seed distribution in the hands of Government makes for safety and efficiency of administration, the comparative dependence on foreign sources for seed supply is undoubtedly an element of weakness. Experience in Kashmir has disclosed that after the first generation the foreign univoltines deteriorate appreciably. This means that the locally manufactured seed is inferior in yield to the imported one. It is quite possible that research may disclose methods of combating the deterioration by the adoption of means for maintaining the vigour of foreign races; but till this is done it is important that effective steps should be taken to secure regular and adequate supplies of good foreign seed.

Nature of Problem.

Kashmir.

26. In Bengal there are three indigenous races, Nistri, Chhotapoloo, and Barapoloo but these are not considered satisfactory. Chhotapoloo and Barapoloo may be considered almost extinct through hopeless degeneration and could at best be reared in but one crop a year. The main problem in Bengal is to provide a seed supply capable of producing better cocoons. Introduction of hybrids namely, Nismo and Nistid, by the Department was a marked improvement; but successful rearing of them in hot and rainy seasons was found difficult. The Bengal Government, it is understood, has sanctioned a scheme of Seed Organisation designed to meet the entire seed requirement of the province by programmed development in a period of five years. Under this scheme the seed supply is to be cellular; 30 per cent of it is to be issued from Government Grainages and the other 70 per cent from Grainages under Government supervision and control. There is also an idea of importing foreign races for the purposes of hybridization, but the advantages of hybrid seed being still problematical, its introduction is to be considered only if

Bengal.

experiments yield satisfactory results. This scheme seems to be sound and the Panel have no remarks to offer.

Mysore.

27. The present seed position in Mysore is that examined seed meets only about 30 to 40 per cent. of the total requirement. For reasons, some of which were beyond control, seed production has lagged far behind mulberry cultivation, and there is much leeway to make up. Mr. H. S. Govinda Rao, Head of the Mysore Sericultural Department, said that his Government has a scheme for increasing the supply of examined seed by about 6,000,000 of layings a year so that in five years the total production including the existing one would be about 5 crores of layings as against the total demand of 6 crores for 70,000 acres under mulberry. The acreage under mulberry is at present 78,000 and it seems to us that the total requirement would be nearer 8 crores of layings than 6 crores. It is probable that the Mysore programme may have to be revised, especially in view of the fact that improved methods of cultivation are sure to increase the yield of mulberry leaf, and correspondingly raise the demand for seed. Mr. Govinda Rao also brought to the notice of the Panel that seed expansion according to programme had been seriously hampered by the difficulty in obtaining microscopes. In spite of persistent and strenuous efforts since 1942 his Department has been able to secure only 65 out of a total requirement of 165 microscopes, and even these supplies came in at long intervals. It is stated that the seed position in Mysore is improving rapidly, and that new seed areas are being opened out for securing an adequate supply of seed cocoons of the Mysore race. The crux of the situation here seems to be an assured and sufficient supply of satisfactory seed cocoons of foreign races, because the demand is for First Generation hybrids for the production of reeling cocoons.

28. The organisation of seed production in Mysore consists of Government, and Subsidised Private grainages. The present strength is 17 Government and 120 Aided Grainages. The maximum annual production in an Aided Grainage is 500,000 layings or roughly 3,500 oz. The Aided Grainages receive a subsidy from Government fixed *pro rata* on the quantity of disease free seed manufactured by them. They are subject to Government supervision and have to furnish returns and reports about their work. They obtain seed cocoons of the Mysore race from approved seed areas, and layings of foreign races from Government grainages which they either rear themselves, or cause to be reared by selected agency, for the foreign race cocoons required. With these they prepare one generation of hybrid cellular seed which they distribute to the villages assigned to each grainage. The original seed, both Mysore and foreign races, is issued from the Government grainages. In regard to Mysore seed, it is first propagated by distribution to selected rearers in exclusive

seed areas where the rearer is under strict supervision and control. It is these seed areas that supply the Aided Grainages. The foreign eggs are prepared cellularly in Government grainages and distributed direct to the Aided Grainages.

29. As a system this is quite sound ; but the actual working has been seriously handicapped by inadequacy of foreign seed and occasional unreliability of the seed cocoon areas. Efforts are being made to overcome the latter difficulty.

Madras.

30. The problem of Madras is exactly similar to that of Mysore. Madras has recently been able to secure some selected varieties of foreign races, through her Silk Expert who was deputed to China for this purpose among others ; and has also a well-equipped Hill Station for the propagation of these races at Coonoor on the Nilgris. According to the reports received by us there were, in 1944-45, 6 Government and 30 Aided Grainages working on lines similar to those of Mysore. Mr. A. T. Janakiram, Silk Expert, Madras, informed the Panel that about 60 per cent. of the seed requirement of the province is being met and that it is hoped to meet the whole in a couple of years. Mr. Janakiram also informed us that his Department's plan is to concentrate the entire production of seed in Government Grainages, and gradually to liquidate the aided system. He thought disease free seed such a vital concern that it should not be left to private agency which might prefer personal gain to quality. This is probably feasible in Madras which has a compact sericultural area.

Seed Requirement of Indian Sericulture.

31. Taking the present area under mulberry in India, excluding Kashmir, at 1,13,000 acres, the total requirement of seed would be about 12 crores of layings requiring about 300 fully equipped grainages. The cost of buildings and equipment of each grainage would be about 20,000 rupees.

32. To enable the grainages to function efficiently, it is necessary to organise special seed cocoon areas for the production of indigenous races and hill stations for the rearing of foreign races without deterioration. The cost of these items varies so greatly according to localities and conditions that no useful estimate of cost can be prepared. It is probable that the co-operation of Kashmir which has experience, and, so far as can be seen, a suitable environment, may be very useful in the solution of the problem relating to foreign races.

Essential Requisites of a Sound Seed Organisation.

33. The requisites of a seed supply for India are :

(1) Effective control of the seed organisation by Government,

(2) Effective retention by Government agency of supply of original seed,

(3) Efficient organisation for supervision of technique and ensuring honest work by Aided Grainages,

(4) Insistence on the cellular manufacture of seed,

(5) Arrangement for adequate and efficient supply of suitable foreign races

(6) Statutory control of silk worm diseases and

(7) Continuous research and work on the improvement of the races and combinations reared.

Should Industrial Seed be entrusted to Aided Private Agency.

34. In regard to the agency for the manufacture of industrial seed, Madras favours centralisation in Government hands, while the practice in Mysore conforms to that prevailing in Japan. In Madras, concentration is possible because the area is comparatively small and compact. In Mysore the system of aided grainages has been found to work quite satisfactorily, and it has besides the advantage of opening out a career for educated young men in rural parts. The relative merits are probably a matter of local expediency depending on the volume of the demand and the aptitude and character of the personnel available, and the Panel would prefer to leave this question open. But there is one point on which they would like to insist, and that is, the necessity for strict State Control and the necessity also for a subsidy or bonus to the aided seed producer. If seed is entrusted to private agencies, it must be borne in mind that the manufacture of disease free eggs involves very heavy risks, and is more often than not unremunerative to the honest worker. The strain is hardest in difficult periods, such as when silk worm diseases prevail, and when it is most important to supply good seed. Aided graineurs should be regarded as people who render an essential service which otherwise would have to be done by the Government itself at much greater cost. They should be treated generously and should receive a bonus or subsidy such as would enable them to be thorough in their technique, and still get a reasonable return. In Mysore the following rates of bonus have been recently sanctioned :

Need and Justification for State Aid to Aided Grainages.

Rs. 2-8-0.—For every 1,000 layings prepared and distributed by the Aided Grainages.

Rs. 1-4-0.—For every 1,000 layings prepared and distributed by the Aided Grainages which have received assistance for five years or more.

These rates by no means err on the liberal side.

III.—Control of Silk Worm Diseases.

Legislation for Control of Silkworm Diseases.

35. In all sericultural countries laws have been enacted enabling the control of silk worm diseases. The need for this is so obvious that we do not consider it necessary to labour the point. In Mysore there is an enactment enabling the introduction of control in notified areas. A copy of this enactment

is annexed to the report, and similar legislation is recommended for other parts of India.

IV.—Improvement of Rearing, Reeling, Organisation and Marketing.

36. (i) *Rearing* :—There is at present much avoidable loss in rearing as the result of ignorance of correct technique and penny-wise economies in later stages. It is stated that in Mysore the loss from causes other than silk worm diseases is about 25 per cent for pure Mysore and 14 per cent for cross-breeds at the present day. The condition in other provinces may not be dis-similar. The empirical knowledge possessed by the peasant rearer is usually enough to enable him to get a fair crop if nothing goes wrong. Even so, there is a wastage of about 20 to 25 per cent. in brushing, cleaning of beds, etc. With some instruction in correct methods perhaps a half of this loss can be avoided. If anything goes wrong the rearer feels helpless, or adopts quack remedies which in spite of repeated failure still retain their vogue. It is here that skilled supervision and advice can save this situation. Another source of loss is the unscientific crowding of worms in the mounting stage to make a small saving in Chandrike hire. There is in Madras and Mysore a chronic shortage of chandrikes in each sericultural village, which despite actual experience has not been rectified.

Itinerant Supervision of Rearing.

37. An itinerant staff of trained men whose duty it is to inspect rearings in definite groups of villages assigned to each unit might do much to remedy this defect and educate the younger generation in correct methods. The institution, at well equipped and conveniently situated Government Farms, of short term popular courses, consisting of one complete cycle of rearing, and comprising both instruction and practice suited to the comprehension of the ordinary peasant sericulturist would be of great value, and is strongly recommended.

Practical Short Courses in Government Farms for Raiyats.

Sericultural Co-Operative Societies.

38. There is a good deal of avoidable waste of effort in the earlier stages of rearing, which can be remedied by co-operation. In fact, co-operation would furnish a solution to all the above troubles. The essential activities comprised in rearing consist of mulberry cultivation, seed supply, feeding and care of silk worms, and marketing of cocoons. A co-operative society could assist and secure economy in each of these by starting nurseries and supplying manure; by starting an aided grainage; by engaging trained sericulturists for the care of the silk worms in the earlier stages, and in case of unexpected difficulties; by stocking and making available such appliances as stands, trays, chopping-knives and chandrikes; and by providing short term credit. A co-operative society could also render useful service by grading cocoons and selling them collectively in the joint interest. The more influential co-operative societies might even have financial backing enough to start filatures of their own.

39. In Mysore a scheme has been prepared to start 35 co-operative societies at the rate of 7 per year for the purpose of starting aided grainages and providing the members with rearing appliances and short-term credit. According to the scheme, in addition to making an initial grant for buildings and equipment, Government will lend a trained man on a salary of Rs. 50 per month for each society, to be borne in equal proportions by Government and the Society. The scheme includes the strengthening of the staff of the Departments of Sericulture and Co-operation for the administration of this development. It is understood that Mysore has under active consideration a scheme for a State-Aided Co-operative Sales Depot for raw silk with the two-fold object of eliminating the disadvantages of dealing through an economically stronger middle man, and of creating an agency for the grading and standardisation of even Charaka Silk. Since the replacement of charakas by filatures can only be a gradual process, an organisation of this kind may not only remove a present defect, but serve to smoothen the transition from charkas to filatures. The Panel are of opinion that the formation of co-operative societies on lines suited to local circumstances would be of great assistance in consolidating the existing industry, which is the first and perhaps the most important stage of our plan of development. They do not propose to go into details, as they think that if the necessity for co-operation is accepted, as they hope it will be, the implementing had best be left to Provincial authorities concerned.

Importance of Reeling.

40. (ii) *Reeling.*—The best cocoons in the world can be spoiled by bad reeling. Reeling is therefore the outward expression by which the sericultural industry will be judged by the world. The ideal of reeling is to extract the filaments from the cocoons without break of continuity or loss of their natural qualities of lustre, strength and elasticity, and combine them into a compact yarn of the required thickness. Reeling is the process which harnesses the natural excellence which makes silk the queen of textiles, to the highest requirements of the art of the weaver. It is easy to see that this process requires a careful and perfected technique. The best machinery and processes are those which have been evolved in advanced sericultural countries as a result of long experience and special study. Unfortunately, except in Kashmir where silk is the monopoly of the State and filatures were established by Government from the outset, the bulk of reeling in India, till recently, used to be done on primitive appliances called *Charakas.* The result of this crude method is, that though the cocoons produced by the rearer may be of good quality the reeler converts them into silk poor in all the qualities most prized by the weaver. The silk is neither compact, nor uniform in size, nor clean, nor strong and elastic as silk should be. An even more serious defect is that it is not continuous, for when the thread breaks on the jerky

What Reeling Meant.

Filature Reeling, the best method.

charaka the broken ends are not knotted but a new end is thrown on. This makes the charaka silk deplorably bad in winding quality and unfit for working with speed machinery.

41. Charaka reeling has been the defect which has confined Indian silk to a narrow market and prevented it from becoming a world commodity. It is very probable that with the change which came over the nature of the weavers' demand owing to his familiarisation with imported silk, the charakas would, in course of time, have mended their technique and combined themselves into filature establishments, or else been displaced by filatures. But the outbreak of war brought in this transformation with a rush, because the Government of India, to meet the urgent demand of the United Nations for parachute silk, extended special encouragement to the filature industry.

42. In 1939-40 the number of filature basins in India were 1,291, of which 891 were in Jammu and Kashmir (Jammu 155, Kashmir 736). In 1944-45 the total number had risen to 4,639, though the number of basins in Jammu & Kashmir remained unaltered.

Statement Showing the number of Filature Basins working in India.

	1939-40.	1940-41.	1941-42.	1942-43.	1943-44.	1944-45
Mysore ..	150	200	295	500	1,361	1,437
Bengal ..	100	120	140	180	1,231	1,735
Madras ..	150	150	150	150	576	576
Jammu ..	155	155	155	155	155	155
Kashmir	736	736	736	736	736	736
Total ..	1,291	1,361	1,476	1,721	4,059	4,639

Though the filatures brought into existence by Government aid had to supply silk at controlled prices very little above the cost of production, yet the grant of priorities and the assurance of a sale provided a cover under which they developed in security. It was a great opportunity for the industry.

43. The problem now is to maintain the development which has been reached and to go on with the work of gradual displacement of charakas by filatures. As against charakas the filature industry requires no protection at all from the State, for the inherent superiority of its product will ensure its prevalence. But protection will undoubtedly be required against other dangers which beset it in the rapidly changing conditions of the post-war period. The comparative shelter under which the industry developed during the war, when its products were required by Government, and when there was no competition from outside, has ceased to exist. Filature silk can only be sold in open market against world competition; and it is here that the need for State action arises.

44. The industry is a great asset both in peace and war, and fully deserves protection. It has been found by two Tariff Boards fully to satisfy the conditions which have been accepted as entitling an industry to protection. We think also that there should be as far as possible a continuance of the priorities for material which were so powerful an aid to expansion during the war. The quality of Indian filature silk should be improved by the authoritative establishment of definite standards conforming to accepted International grading, and by the establishment of a system of Government Conditioning Houses for enforcement of such standards. The industry should, for its part, organise itself, and aim at greater efficiency and reduction of costs. The filatures should organise themselves into regional Filature Associations which in their turn should be affiliated to a Central All-India Silk Association, for the maintenance of a uniform policy in regard to purchase, production and sale.

V.—Development of the Spun Silk Industry.

45. The spun silk industry is an essential part of sericulture, more especially of the reeling section of it, since it enables the profitable utilisation of silk waste which is a by-product of filatures and charakas. In a competitive world market anything which helps to bring down costs is an essential factor of success, and the part played by the spun silk industry in this regard can well be described as of the first importance. It is an article of faith with reelers that while the realisation from raw silk just covers cost, it is the sale of silk waste that gives them their profits. A scrutiny of the accounts of filatures also bear out the justness of this belief. The function of a spun silk mill is to work up the silk waste which is the unreelable, because discontinuous, part of the silk content of the cocoon, into a continuous yarn known as spun silk. As the production of every pound of silk in a filature results in a by-product of rather more than 0.6 of a pound of silk waste it will be seen how important the utilisation of this product is. Formerly all the waste in the country used to be collected by local traders and sold to large exporting firms. Only a small part of the value came to the reeler. To remedy this state of things, a spinning mill, called the Mysore Spun Silk Mills, Ltd., was started at Channapatna, Mysore State, with Government assistance and participation, with 3,000 spindles specially designed to handle the inferior waste which was the only stuff available at the time. This enterprise did so well for itself and its environment that it developed rapidly and has recently purchased another 3,000 spindles belonging to the "Jaya Spun Silk Mills" of Bombay. When this outfit is transferred to Channapatna, as is the intention, there will be 6,000 spindles working at Channapatna with a total production of about 120,000 pounds of spun silk, utilising 600,000 pounds of silk waste out of 7 to 8 lakhs of pounds produced in Mysore

Rajasabha Bhushana Diwan Bahadur K. R. Srinivasiengar, M.A., Chairman and Managing Director of the Channapatna Spun Silk Mills, who has extensive experience of all sections of the silk industry as former President of the Mysore Silk Association, is strongly of opinion that the spun silk industry of India should be looked upon as a necessary complement of the filature industry and an essential part of the sericultural industry, and should receive the same solicitude and protection. He recommends that exports of silk waste from India should be prohibited and that the spun silk industry should be developed to the extent necessary for utilising the entire quantity of silk waste produced in the country. He adds that if the existing spun silk mill could expand and take up the whole of the silk waste produced in this country it should be permitted to do so ; but if it was thought that it would be more convenient to divide the spun silk industry into two zones, north and south, with clearly defined spheres of operations, he could see no objection. But the essential thing is to avoid internal competition. He is afraid that owing to the difficulty of getting machinery it might be several years before this object could be achieved, so that to start with there might be an unutilised surplus of silk waste. There was a discussion as to what should be done with this unutilised surplus. If it was permitted to be exported without control, then foreign buyers by paying higher prices for this waste would raise the price even of the waste purchased by the mills, and the industry would thus be indirectly exposed to foreign competition. Finally on the suggestion of Rai Bahadur S. N. Bose it was agreed that even from the outset all the silk waste produced in the country should be purchased by the spun silk mill or mills at a fair price fixed by a small representative Board; and that if in the initial stages this should be in excess of actual requirement such surplus alone should be permitted to be exported by the spun silk mills themselves who should be sole agents for exports of silk waste. At a subsequent meeting Mr. Peychaud objected that if export of silk waste was prohibited, and the spun silk mills were given a monopoly of the article, it would be entrenching them in a position whence they could dictate their own prices. This, he said would be unfair to the filatures and charaka reelers, since their profits almost wholly consisted of what they could get for their silk waste. He contended that either the filatures and reelers should be left free to sell their silk waste in the best market, or some definite machinery should be set up for fixing a price that would be fair to both sides. It was agreed that the satisfactory working of the entire scheme essentially depended on the fixing of a price which would be acceptable to both buyer and seller, and that this could only be done by an authoritative committee containing representatives both of reelers and spun silk mills, constituted and controlled by the Central Silk Board, the setting up of which will be recommended later on in the Report.

46. A question was raised whether the Panel in recommending the zonal distribution of spun silk mills contemplated only two spun silk mills—just one in each zone—or two groups of mills. The Panel do not intend to place fetters on the starting of more than one mill in each zone, provided that it was an economical unit; but they are emphatically of opinion that mills in the same zone should be associated in regard to purchases and sales in such a manner as effectively to abolish competition and clash.

47. The Panel make the following recommendations relating to the spun silk industry :

(1) That for the purpose of the spun silk industry, India may be divided into two zones, north and south, and that there may be but one spun silk mill or group of associated mills for each area dealing with all the waste produced in it, and that these mills should purchase all the silk waste in their respective areas at a fair price to be fixed from time to time,

(2) That what is a fair price shall be assessed by a small committee consisting of representatives of both filature and spun silk mill interests appointed by, and working under, the general direction and control of, the Central Silk Board of India,

(3) That exports of silk waste from India should be prohibited,

(4) That the spun silk mills should be afforded all necessary priorities and facilities for manufacture and transport of machinery to expand their operation sufficiently to cope with their responsibility, and

(5) That they should be regarded as sole agents for the export of Indian silk waste but permitted to export only the unutilised surplus that they, in spite of their best efforts, have not been able to utilise.

48. Another suggestion received was that mutuality of interest between the filatures in a zone and the spun silk mills concerned should be promoted by each holding shares in the other. This is worth the consideration of the interests concerned.

VI.—Organisation and Inter-Provincial and States Co-Operation.

49. It is necessary to organise the industry both in its constituent parts and as a whole. The Panel are fully alive to the difficulties of the task. All branches of the industry have to be organised and co-ordinated into a well-knit whole. Seed manufacturers should be organised for the better discharge of their responsible functions; cocoon producers should have their own organisation for a fair marketing of their cocoons ; filatures and spun silk mills should likewise form

regional associations; there should also be associations of silk merchants. The various associations in a region should come together in a Silk Association for the State or Province concerned, enjoying recognition and support from the administration of the region. The Regional Silk Associations should be federated in an All-India organisation which may be called the Central Silk Association of India, through which the country's industry as a whole can express itself in an articulate and coherent manner.

State Action —Need and Scope.

50 We are aware, and indeed nothing can be more obvious than this, that progress along the lines of action recommended above is essentially dependent on a generous State policy of initiative, pioneering and assistance. We are in entire agreement with the Tariff Board for silk when they say :

> " Concerted action in the industry in all parts of India is imperative for the existence of the industry as also for the improvement " (Para 41, Report 1934).

51. Some of the recommendations involve action which only the State can take; for instance, scientific research without which talk of improvement would be idle, control of silk worm diseases, spread of co-operation and knowledge, protection against foreign competition, and establishment of internal solidarity by inter-provincial and states' co-operation. These are patently objects not within the competency of individuals or private associations; they can only be attempted and achieved by a central authority working through, and in co-operation with, Provinces' and States' administrations.

Import Technical Aid.

52. It may be necessary in the initial stages to obtain the assistance and advice of technicians from abroad. The Panel believe that there is already so much knowledge and experience available in India that it is only on rare occasions and for specific purposes that foreign assistance may be necessary. The fact of necessity is one for the Central Silk Board, to be constituted as recommended herein after, to find. If a case has been made out, the Government should accept the responsibility of engaging the services of experts from abroad.

Enforcement of Standard of Quality.

53. The establishment and enforcing of uniform standards of quality throughout India is also legitimately in the province and state action.

54. Even of the other activities outlined in our plan of development there are hardly any which can dispense with State aid for their progress on healthy lines.

Research.

55. In the opinion of the Panel there should be a well-equipped research institution for each Sericultural Region and a Central Institute for the whole of India where the results of research in the regions are collected and co-ordinated.

Regional Stations.

There must be a free interchange of results, reports, and ideas between the regional and the central institutes. The Central Institute should provide facilities for representative workers

from the regional institutes to conduct or complete work started by them in the regions. The regional institutes need not confine themselves to purely local or regional subjects or objectives, but might conduct every grade and class of work for which they have talent and facilities. The Central Institute should function in addition to its research activities as a place for pooling information. It may include in its scope of work investigations relating to tussar and other non-domesticated silks.

Central Institute.

56. The Mysore Scheme for the establishment of a Central Institute at Channapatna was considered. There is no doubt that the Mysore Research Institute would enjoy considerable advantages of position and environment being in the midst of one of the best developed sericultural tracts of India, and that it has also been conceived on a broad and comprehensive basis. If this institute is constituted and organised on the lines recommended, it is a point for consideration whether it could not be adopted as a Central Institute for the whole of India, and provided with facilities for the sericultural provinces and states to depute scientists to conduct research on their behalf. The Panel feel that, provided the equipment and personnel at the Channapatna Institute are efficient, it would be an extravagant waste of effort to duplicate an institute of that magnitude. They think that in addition to the scientific sections specified in the Mysore Scheme there should be one for the study of sericultural economics, for the utilisation of material made available by the scientific sections.

57. The Mysore scheme provides for a research institute with 6 departments—Physics, Chemistry, Botany, Zoology, Sericulture and Engineering and involves a total expenditure of 16.99 lakhs initial and 2.47 lakhs recurring.

58. Mr. K. Shamsuddin Khan from Mysore State urged that higher education of University standard should be provided in sericulture. His proposal was that there should be a College course leading to B.Sc. (Sericulture) just as there is at present one leading to B.Sc. in Agriculture. The Panel are in cordial agreement with this proposal.

59. *State Aid and Control*—The Panel consider it superfluous to urge the self-evident claims of the sericultural industry for protection. They are of opinion that the State should take measures to ensure to workers of all grades in the industry, from seed manufacturers and rearers to the reelers of silk, a remuneration considered sufficient to be an incentive both for continuance and improvement. The rate of remuneration has to be fixed and revised from time to time to accord with altering circumstances, such as the cost of living, prices of agricultural produce which compete with mulberry, and wages of labour. The level of price so determined should be secured and protected by a tariff policy when conditions make such a

Aim to Secure Reasonable Remuneration to Basic Workers.

course imperative. On the insistence of the representatives of all Provinces and States, and in full agreement with them, the Panel would lay special emphasis on the necessity for vigilant tariff protection.

60. *Control of Prices* :—Experience of the control of silk has disclosed the almost insuperable difficulties of operating it on an all-India basis, and the tendency of each province to deviate from it according to its own needs and circumstances. This has resulted in disorganisation and malpractices. Having regard to the fact that the general policy is towards decontrolling, and that silk is an article of luxury, this Panel is of opinion that silk should be decontrolled without delay.

61. *Standardisation of Products* :—It is essential that the State should concern itself with improving the quality on the country's silk, by establishing, and maintaining standards. This can only be done by establishing Government Conditioning Houses. We recommend that every producing State or Province should set up one or more Conditioning Houses and the certificates issued by them should be a guarantee of quality. The Conditioning House should conform to International Standards. In addition, to deal with silk imports, there must be at each port of entry a Conditioning House run by the Central Government. The existing Conditioning House at Calcutta might be retained by the Central Government and fully strengthened and equipped. The Central Government should appoint an all-India Inspector of Conditioning Houses whose duties should be to visit periodically all the conditionings houses in India and make a report to the Silk Board to be set up by the Central Government.

62. The establishment of a system of Conditioning Houses throughout India will lead to the gradual displacement of crude appliances and methods of reeling by modern filatures and a better technique. In fact, State policy must aim at improving every branch of the industry from moriculture to the production of raw silk, and the last is not the least important, since without it, all the rest would be largely futile.

63. When the draft Bill for the regulation of licensed warehouses in India is put on the Statute Book, it would be highly advantageous to bring this provision into operation in Sericultural Provinces and States. We strongly recommend this course. The best method of popularising warehouses would be for Government to attach a warehouse to each Conditioning House established. This would facilitate the work of the conditioning houses and help the gradual upgrading and standardisation of silk.

Second Stage.

64. The second stage of development is the expansion of the industry to meet the entire Indian demand. This, in fact,

involves the third stage also, viz., the utilisation of all-India's potentialities for the production of silk. The Indian consumption of silk in 1938 was about 10-1/4 million pounds :

1,500,000 lbs.—Silk produced in India

2.250,000 lbs.—Raw silk imported

6,500,000 lbs.—Silk imported as manufactured fabric.

Limits of Expansion.

It is probable that in the post-war period there might be an increase in the silk consumption of India. It may not be far from correct to assume that during the period for which we are planning, the Indian demand may mount up to 15 million pounds. To produce this quantity of silk in India we would require an area of about 750,000 acres under mulberry. Whether land to make up this total is available in suitable areas, and if so, whether the national economy can spare it from food production for silk, are points on which we have no sufficient information. The States and Provinces in their forecasts have set for themselves a target for the expansion of mulberry to a further 49,868 acres in the next five years as per details given below :

	Pre-war.	Present.	Target.
Mysore	26,500	78,000	1,00,000
Madras	7,060	18,026	25,000
Bengal	10,086	15,550	25,000
Bombay	..	20	5 000
Bihar	..	20	5,000
Central Provinces	..	16	2,500
Total ..	43,646	1,12,632	1,62,500

This may be accepted.

EXPANSION DURING THE THIRD PERIOD OF FIVE YEARS.

Ultimate Target.

65. Generally speaking, after a particular stage of expansion has been reached, further additions become increasingly difficult. We do not think that during the final period of five years the expansion of mulberry cultivation is likely to be more than about 25,000 acres which will give us a total area of 1,87,500 acres for India excluding Kashmir. The case of Kashmir has to be considered separately, because the basis there is the number of trees and not the acreage. We are informed by Mr. Peychaud that during this period of fifteen years an increase of 50 per cent. may be expected in the production of silk in Kashmir. On an average calculation we might expect to produce annually about 3,750,000 or 4,000,000 pounds of silk in India at the end of fifteen years. We feel that this is a practicable target. This requires consolidation of the present position on the lines we have indicated, and further development on the same lines without any sacrifice of

efficiency. When we have reached this limit there would still be a deficit of over 11,000,000 lbs. of silk which India would have to import. It seems to us, therefore, that the most that could be attempted during the next fifteen years is consolidation of the existing position and gradual expansion such as would enable India to meet about a fourth of her total requirements of silk. We would here emphasise the necessity for discrimination in India's tariff policy between imports of raw silk, and imports of silk fabrics. In the interests of the weaving industry, this discrimination must be decisively in favour of raw silk—and this is a point which cannot be over-emphasised.

Export Markets

66. In these circumstances there would never be any surplus, as such, for catering for the export market except as regards artistic fabrics. But it would be unwise to shut out the possibility of exports altogether, since as producers of a world commodity we should secure a certain amount of world publicity. It is also conceivable that cases may arise when our most advantageous means of obtaining goods we need from a foreign country may be to trade our silk there.

Recommendations as to Foreign Raw Silk entering as War Reparations.

67. The Panel understand that a large quantity of raw silk and silk piece-goods from Japan is coming into the possession of the Government of India by way of war reparations. The price fixed as between Japan and India for these goods will be on the basis of the realisation on Japanese silk in New York. We understand that the ceiling prices imposed by buyers in America on Japanese silk is $3.5. This price is so fantastically low as to have no relation at all to the realities of Indian silk production. The effect of releasing silk at the same price on the silk market in India would be disastrous to the indigenous industry. Though the circumstance is temporary, the shock may have serious consequence. This Panel are, therefore, of opinion that, no matter at what prices the silk is acquired by the Government of India, it should only be released in the Indian market at the prevailing price of Indian silk. This price may be the controlled price, if control is in operation, or else the silk may be sold by public auction after due publicity. The resulting profit naturally belongs to the Indian Government as representing the Indian nation. The Panel recommend that a very considerable part of this profit might be utilised for the benefit of the silk industry and for implementing the recommendations made in this report.

Essential need for a Central Silk Board.

68. The Panel trust that the recommendations submitted above when approved by Government will constitute a definite policy calculated to develop the sericultural industry to the limits of its natural scope. We have next to devise an efficient and capable organisation for implementing that policy. Such an organisation must combine an intimate knowledge of the industry on both the technical and commercial sides, with official authority to give effect to its findings. It should also

be such as to secure the adherence of all sericultural parts of India by giving them reasonable participation in deliberations on matter of policy. It is only live touch that can adapt policy to the varying needs of a living and growing industry. The Panel strongly recommend the setting up of a Central Silk Board of India, so constituted as to bring together the knowledge and interests of all silk producing parts of the country. On this Board each sericultural province or state should have two representatives, one representing the administration of the province or state, and the other the private interests in it. If there is a Silk Association it may be given the privilege of electing or nominating the member for private interests. If there is not, the Provincial Government may, till a Silk Association is formed, be asked to nominate the representative of private interests also. As the privilege of representation comes to be realised and appreciated this would stimulate the formation of sericultural associations which is one of the objects we have in view. The Military Department (Controller-General of Inspection) might be allowed to send a representative. The Board may be presided over by the Member in charge of Industries, or if that is not possible, by the Secretary of that Department. We are of the opinion that the Board should be a statutory body, entitled to be consulted on all matters of policy relating to sericulture, such for instance as control legislation, and protective measures. It should have a Secretariat of its own staffed by technically competent officers. It should be entitled to be consulted on all matters of policy. It should also have control of the Central Research Institute.

Recommendations for constitution.

69. The Panel met the representatives of the States and Provinces for a discussion of the recommendations made in the Report. The recommendations, on the whole, have received a very encouraging measure of support and agreement from all quarters. The valuable suggestions received from the representatives of the States and Provinces have been further considered by the Panel and incorporated in this Report which may be regarded as final.

N. RAMA RAO,
Chairman.

Members.

S. RATNAM,
H. PULMAN.
S. N. BASU,
R. PEYCHAUD,

HUMAYUN MIRZA,
Secretary.

SUMMARY OF RECOMMENDATIONS.

While the scope of their enquiry is a world commodity like raw silk which in its development from the cocoon of the silkworm into the product of the filature, passes through the operations of moriculture, sericulture and reeling, each process giving occupation to a difficult set of more or less skilled operatives and forming a separate branch of the silk industry, the Panel have left to each of the concerned Provinces and States to set up a committee of experts to advise on the development of such of the non-domestical silkworms (tassar, muga and eri) as are found in their respective areas.

The Panel have decided that in the context of Indian food conditions as they are and as expected to continue the development of the silk industry will have to be mapped out over a period of 15 years in 3 stages of 5 years each as follows :—

The First Quinquennium.

The marked difference of 68,986 acres between the present and pre-war figures of acreage of bush mulberry cultivation as revealed by the following statement is indicative of the stimulus provided by the war for such imperative needs as the fabrication of parachutes *et cetera* :—

State/Province.	*Prewar.*	*Present.*
	acres.	acres.
Mysore	26,500	78,000
Madras	7,060	18,026
Bengal	10,086	15,550
Bombay	..	20
Bihar	..	20
Central Provinces	..	16
	43,646	1,12,632

Now that the incentive provided by war needs is no longer present, Government's assistance and encouragement for safeguarding such an essential national asset as the silk industry is an urgent necessity. The Panel are, therefore, of opinion that the first five-year period should be devoted to careful stock-taking of what has so far been achieved and every effort directed to maintaining the existing position of the silk industry by consolidating the present position, the requisites of consolidation being—

(a) improvement of mulberry cultivation ;

(b) adequate supply of disease-free seed, and improvement of quality ;

(c) control of silkworm diseases ;

(d) improvement of rearing, reeling, organisation and marketing ;

(e) development of the spun silk industry and full utilisation of by-products ; and

(i) inter-provincial|states co-operation in regard to these objectives.

These main directions of consolidation will help to strengthen all weak links in the organisation of the silk industry so as to adapt it to post-war conditions and for meeting foreign competition.

(a) *Improvement of mulberry cultivation.*—In the interests of the consuming public the cost of production of silk needs to be reduced, beginning from mulberry cultivation (the cost of mulberry represents nearly 60 per cent. of the cost of production of cocoons). To achieving this very desirable end, the Governments of the silk-producing Provinces and States should establish mulberry farms and nurseries at strategic points for the purpose of experimenting with different varieties of grafted and budded mulberry trees, yielding increased and nutritive leaves, and the most suitable varieties from these distributed accordingly. This aspect of sericultural work is stressed in the Madras Government's 5-year plan of sericultural development in that Province. The Panel recommend the preparation of similar plans by the other regional Governments.

Where possible bush mulberry should be supplemented with (not substituted by) tree mulberry by utilising uncultivated margins of land and inferior land no good for food crops. The Panel have come to the conclusion that though the trees need as much care as bush mulberry, the cost of the former's maintenance is much less than that of the latter and also the yield of leaves per acre is less in the case of tree mulberry. All things considered, the Panel have come to the conclusion that consolidation and improvement of the existing position are more important than expansion : that while it is neither possible nor desirable to increase the extent of the land horizontally, you can increase it vertically by increasing its fertility. Moreover, seed production has not kept pace with mulberry expansion. These considerations do not apply to new areas like Bombay, Hyderabad and Travancore which have sericultural possibilities.

(b) *Adequate supply of disease-free seed.*—Each sericultural region has its own peculiar problems in regard to seed. The Panel, in taking due note of this, have the following suggestions to make :—

Kashmir.—Until research discloses methods of combating the deterioration of foreign univoltines so soon after the first generation, Kashmir will need to secure regular and adequate supplies of foreign seed.

Bengal.—As the Panel Report puts it ; " Bengal's main problem is to provide a seed supply capable of producing better cocoons ". In the Bengal Government's 5-year plan of seed organisation, that aspect of it relating to hybrid seed the Panel view with some reservation but, on the whole, the Panel consider the Bengal scheme to be good.

Mysore.—Inasmuch as the extent under mulberry is 78,000 acres, the Panel are of opinion that the increase of examined seed by about 8 crores of layings yearly should be substituted for 6 crores of layings in the mysore scheme. Mysore needs also to secure its full requirement of 165 microscopes.

Madras.—The Madras scheme of concentrating the entire seed production in Government grainages the Panel consider to be feasible as the sericultural area, which is a continuation of the Mysore plateau, is very compact in Madras.

On the subject of Government Grainages versus Aided Grainages, the Panel are of opinion that while, for the reason given above, in Madras it is possible for the agency for the manufacture of industrial seed to be centralised in Government hands, in Mysore, which is a large sericultural tract, it is found expedient to have aided grainages along with Government grainages. The Panel have preferred to leave the question open as the relative merits of Government and aided grainages are matters of local expediency ; but they would insist upon strict State control and they also stress the need and justification for subsidizing some private grainages. The seed requirement of India as a whole is 12 crores of layings requiring about 300 fully-equipped grainages, buildings and equipment of each grainage costing about Rs. 20,000. The Panel further recommend the organisation of special seed cocoon areas for the production of indigenous races and hill stations for the rearing of foreign races without deterioration. In fine, in the Panel's view, the essential requisites of a sound seed organisation are :—

(i) effective control of seed organisation by Government ;

(ii) effective retention by Government agency of supply of original seed ;

(iii) effective organisation for supervision of technique and ensuring honest work by aided grainages ;

(iv) insistence on the cellular manufacture of seed ;

(v) arrangement for adequate supply of suitable foreign races ;

(vi) statutory control of silk worm diseases ; and

(vii) continuous research work on the improvement of the races and combinations reared.

(c) *Control of silkworm diseases.*—There should be an enactment, as in Mysore, to control silkworm diseases.

(d) *Improvement of rearing, reeling, organisation and marketing.*—

Rearing.—The Panel recommend an itinerent staff of trained men to inspect rearings in groups of villages in order to remedy the losses due to diseases, unscientific crowding of worms in the mounting stage in *chandrikes,* brushing, cleaning, etc. The Panel recommend that the chronic shortage of *chandrikes* in the sericultural villages of Madras and Mysore should be rectified. Besides the itinerent supervision of rearing, the Panel recommend practical short courses in Government farms for raiyats. As a sovereign remedy for all the ills that beset the silk industry in its initial stages, the Panel recommend the institution of co-operative societies on lines suited to local circumstances. This is the first and most important stage of the plan of development. Indeed, the Panel are of opinion, " since the replacement of charakas by filatures can only be a gradual process, an organisation of this kind may not only remove a present defect, but serve to smoothen the transition from charakas to filatures ".

Reeling.—The hope of the silk industry in India lies in the displacement of charakas by filatures in the interests of both qualitative and quantitative production. The number of filature basins today is 4,639 as against 1,291 in 1939-40. Filature silk has to face world competition, and it is just here that the need for State action arises. In the words of the Panel Report, " It has been found by two Tariff Boards fully to satisfy the conditions which have been accepted as entitling the industry to protection. We think also that there should be as far as possible a continuance of the priorities for material which were so powerful an aid to expansion during the war. The quality of Indian filature silk should be improved by the authoritative establishment of definite standards conforming to accepted international grading and by the establishment of a system of Government Conditioning Houses for the enforcement of such standards. The industry should, for its part, organise itself and aim at greater efficiency and reduction costs. The filatures should organise themselves into regional filature associations which in their turn should be affiliated to a Central All-India Silk Association, for the maintenance of a uniform policy in regard to purchase, production and sale ".

(e) *Development of the spun silk industry.*—The Panel's recommendations are as follows :—

(i) that for the purpose of the spun silk industry, India may be divided into two zones, north and south, and that there may be but one spun silk mill or group of associated mills for each area dealing with all the waste produced in it, and that these mills should purchase all the silk waste in their respective areas at a fair price to be fixed from time to time ;

(ii) that what is a fair price should be assessed by a small committee consisting of representatives of both filature and spun silk mill interests appointed by, and working under, the general direction and control of the Central Silk Board of India ;

(iii) that exports of silk waste from India should be prohibited ;

(iv) that the spun silk mills should be afforded all necessary priorities and facilities for manufacture and transport of machinery to expand their operation sufficiently to cope with their responsibility ; and

(v) that they should be regarded as sole agents for the export of Indian silk waste but permitted to export only the unutilised surplus that they, in spite of their best efforts, have not been able to utilise.

The Panel also strongly recommend filature and spun silk mill interests in a zone holding shares in each other's concern.

(f) *Inter-provincial/states co-operation in regard to these objectives.*—In recommending the organisation of the industry in its constituent parts and as a whole, the Panel observe : " Seed manufacturers should be organised for the better discharge of this responsible functions ; cocoon producers should have their own organisation for a fair marketing of their cocoons ; filatures and spun silk mills should likewise form regional associations ; there should also be associations of silk merchants. The various

associations in a region should come together in a Silk Association for the State or Province concerned, enjoying recognition and support from the administration of the region. The Regional Silk Associations should be federated in an All-India organisation which may be called the Central Silk Association of India, through which the country's industry as a whole can express itself in an articulate manner".

As regards the action Government should take, the Panel recommend—

(a) tariff protection ;

(b) proper machinery for each branch of the industry so as to improve quality and increase output ;

(c) inter-provincial and states co-operation ;

(d) import of technical aid ;

(e) a Central Silk Board to be constituted, representative of all interests ;

(f) research—each sericultural region to have its own institute and a central institute to co-ordinate the work of all these regional stations, the Central Research Institute preferably being the Mysore Government one at Channapatna. There should also be a University degree in Sericulture ;

(g) de-controlling of silk ; and

(h) silk products should be standardised, for which purpose conditioning houses should be established to which should be attached licensed warehouses. The Central Government should appoint an All-India Inspector of Conditioning Houses.

The Second Quinquennium.

Assuming that the Indian demand will be not less than 15,000,000 lbs. of silk as against the pre-war (1938) demand of 10,250,000 lbs. the area required under mulberry for the production of 15,000,000 lbs. of silk would be 750,000 acres. The Panel recommend proceeding both by way of expanding mulberry cultivation and of intensifying it. By expanding cultivation, the Panel mean bringing more and more land, however little that may be, that permits of mulberry cultivation, and that has not been cultivated, into mulberry cultivation. By intensifying cultivation, the Panel mean producing more leaves per acre of land than has been done so far. All that is possible, however, is 1,62,500 acres as per details below (an increase by 49,868 acres over the first quinquennium) :—

Mysore	1,00,000 acres.
Madras	25,000 acres.
Bengal	25,000 acres.
Bombay	5,000 acres.
Bihar	5,000 acres.
Central Provinces	2,500 acres.
	1,62,500 acres.

THE THIRD QUINQUENNIUM.

The Panel consider that during the final period of 5 years, the expansion of mulberry cultivation is not likely to be more than 25,000 acres, the area thus totalling 1,87,500 acres (excluding Kashmir where the basis of calculation is the number of trees). Inclusive of the increase of 50 per cent. in the production of silk in Kashmir, the Panel do not foresee all-India production to be more than about 4,000,000 lbs. per annum at the end of 15 years. The Indian demand being put at 15,000,000 lbs. the deficit of 11,000,000 will have to be made up by imports. The Panel nevertheless consider that it would be unwise to shut out the possibility of exports altogether for reasons of publicity and of bartering Indian silk for other goods, if need be.

On the immediate question of competition from Japanese silk entering India by way of reparations, the Panel opine that it should not undersell Indian silk ; otherwise the consequences would be disastrous to the indigenous industry.

HUMAYUN MIRZA,
Secretary.

APPENDIX A

Department of Planning and Development.

General Directive to Industrial Panels.

It is the function of panels to make recommendations to Government regarding the development of industries, both existing and new. These recommendations should be so framed as to enable Government to prepare a detailed phased plan for the five years following the cessation of hostilities, as the first stage of a 15-year plan of industrial development for the whole country.

2. In order to assist them to formulate recommendations, panels will be supplied, as far as possible, with factual information prepared by the panel secretaries. In the case of new industries, the information will consist of a general survey of the industry and the importance of starting it in India, the availability of raw material, the power requirements, the demands of the Indian markets and the probabilities of exports. In the case of existing industries, the information will naturally be more comprehensive ; it will indicate, in addition, the location of existing units, the types of goods produced, the total production under each category and the assistance, if any, given by Government. These items are to be regarded as illustrative and not exhaustive.

Government will give each panel, as a basis, for discussion, the provisional target to be aimed at in the first five-year period and, wherever possible, of the target to be reached in 15 years.

3. The recommendations of the panels should cover the following points :—

(1) The scope and extent of development, including the type of products recommended.

(1-A) The estimated requirements of capital goods together with such details of those requirements as may be available in India and how much should be imported from abroad.

(2) Whether the industry should be under Government ownership either on grounds of national interest or because private capital is unlikely to take it up, and if so, whether it should be wholly or partly managed by Government.

(3) In the case of industries to be developed other than under State ownership, the capital required for such development, whether the whole of it is likely to be available by public investment and, if not, the extent to which Government assistance may be required.

(4) The extent to which technical advice from abroad may be necessary.

(4-A) The availability and the future requirements of technical personnel so as to obtain a clearer indication of the present short-comings and future needs.

(5) The manner and the degree of co-operation with foreign firms considered necessary and desirable, both as regards capital and management.

(6) The location of the industry.

(7) The nature of the assistance required from Government in the form of protective duties, bounties, research grant, expert advice, etc.

(7-A) The relative incidence of the import duty on the finished goods in comparison with the duty on the raw materials from which they can be manufactured.

(8) If the industry is to be under private ownership and management, what controls, if any, should be exercised by Government.

(9) What should be the organisation of the different units of the industry, e.g., should there be an industrial association ? Would a cartel be desirable ?

(10) The stages by which the industry should be developed.

(11) Should the industry cater for the export market ?

(12) Should the industry be developed, as in Japan, on the cottage industry basis and, if so, to what extent ?

4. Although, as stated above, the panels may recommend the grant of protection, it will not be their function to consider broad questions of international trade and commercial policy.

5. Joint meetings of the panels should be held, wherever necessary to secure co-ordination particularly where the processes and the products of one industry are connected with those of another.

6. Some of the panels have been drawn broadly and it may be necessary to co-opt members for dealing with specific branches of the industry. Members may be co-opted by the Chairman in consultation with the Industrial Adviser.

7. Before submitting recommendations, panels should consult Provincial Industrial Committees, particularly in the matter of location of industry. They should also, where the circumstances of the case require it, consult Industrial committees in States or State Governments/Durbars. The recommendations should be submitted to Government through the Industrial Adviser.

APPENDIX B.

GOVERNMENT OF HIS HIGHNESS THE MAHARAJA OF MYSORE.

The Mysore silk-worm diseases Control Act, 1943.

ACT NO. VII OF 1943.

Whereas it is expedient to provide for the control and eradication of silk-worm diseases in Mysore;

It is hereby enacted as follows :—

1 (i) This Act may be called the Mysore Silk-worm Diseases Control Act, 1943.

(ii) It extends to the whole of Mysore.

(iii) This section shall come into force at once. The Government may by notification in the official Gazette apply all or any of the provisions of this Act to such areas in Mysore as may be specified in the said notification.

2. In this Act, unless there is anything repugnant in the subject or context :—

(i) "prescribed" means prescribed by rules made under this Act;

(ii) "seed" means and includes seed cocoons, moths, eggs and silk-worms in the first two stages of development;

(iii) "Seed-producer" means any person engaged in all or any of the processes connected with the manufacture or disposal of seed including processes from the selection of seed cocoons to the distribution of seed;

(iv) "seed rearer" means any person who carries on all or any of the processes connected with the rearing of silk-worms with a view to the sale of cocoons for the purposes of seed including operations extending from the incubation of eggs to the harvesting of cocoons.

(v) "silk-worm disease" includes the diseases of Pebrine, Flacherie, Grasserie and Muscardine and any other disease which may be notified as such by the Government.

(2) Prescribing the form, if, any, in which, and the particulars with

3. (i) Every seed producer seed rearer and every other person, who carries on all or any of the processes connected with the manufacture of seed or the rearing of silk-worms, shall give information forthwith in such form, if any, and with such particulars as may be prescribed, to the nearest officer authorised by the Superintendent of Sericulture to receive such information, of the occurence to his knowledge of silk-worm disease in seed, silk-worm or moth in his premises or under his control.

(ii) For the purpose of this section and in the absence of reasonable excuse, the burden of providing which shall lie upon him, every person specified in sub-section (1) shall, when any disease occurs in seed silk-worm or moth in his premises or under his control, be deemed to have knowledge of the occurence of such disease.

4. (i) Any officer authorised in this behalf by the Superintendent of Sericulture may, between the hours of 6 a.m. and 6 p.m. enter upon any land, building, vehicle or place whereon or on any part of which all or any of the processes connected with the manufacture of seed or the rearing of silk-worm is being carried on or where seed, silk-worm or moth is stored, and inspect the same with a view to detecting the presence or otherwise of any silk-worm disease.

(ii) Every owner, occupier or person in charge of any land, building, vehicle or place shall give all reasonable facilities to the officer authorised under sub-section (1) to inspect.

5. (i) On receipt of information under section 3 or on the detection of silk-worm disease under section 4, and subject to the provisions of sub-section (2), any officer authorised in his behalf by the Superintendent of Sericulture or an officer authorised to inspect under section 4, as the case may be, may take, or cause to be taken, such steps as may be considered by him expedient or necessary to prevent the spread of the disease or to eradicate it. Such steps may include the disinfection or destruction of any seed, silk-worm, moth or of any vessel, receptacle or apparatus used in such manufacture or rearing and such other action as may be prescribed.

(ii) In case where the owner or person in charge of the seed, silk-worm or moth alleged to be diseased does not agree to the destruction under sub-section (1) of such seed, silk-worm or moth or any vessel receptacle or apparatus used by him, then an appeal shall lie to an officer authorised in this behalf by the Superintendent of Sericulture, not being below the rank of Senior Sericultural Inspector, in such manner as may be prescribed, and in any case, not later than 24 hours after action is directed to be taken under sub-section (1). The order of the appelate authority shall be final.

6. Any person, who acts in contravention of, or fails to comply with, any of the provisions of this Act, shall on conviction, be punishable with fine which may extend to Rs. 200. The court may in its discretion direct that any seed, silk-worm, moth or vessel, receptacle or apparatus containing them shall be destroyed.

7. No prosecution under this Act shall be instituted without the previous sanction of the Superintendent of Sericulture.

8. No suit, prosecution or other legal proceedings shall be instituted against any peron for anything which is in good faith done or intended to be done under this Act.

9. Every officer acting or purporting to act in pursuance of the provisions of this Act and rules thereunder shall be deemed to be a public servant within the meaning of section 21 of the Indian Penal Code as in force in Mysore.

10. (i) The Government may make rules to carry out the purpose of this Act.

(ii) In particular and without prejudice to the generality of the fore going provision, the Government may make rules for all or any of the following purposes, namely :—

(1) Notifying such additional diseases, if any, which should be considered as silk-worm diseases ;

which, information should be communicated under section 3 ;

(3) Prescribing the further steps, if any, which may be taken in controlling or eradicating silk-worm diseases under section 5 : and

(4) Prescribing the mode and form of an appeal under sub-section (2) of section 5;

(iii) The Government may also prescribe a fine not exceeding one hundred rupees for breach of any such rule.

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